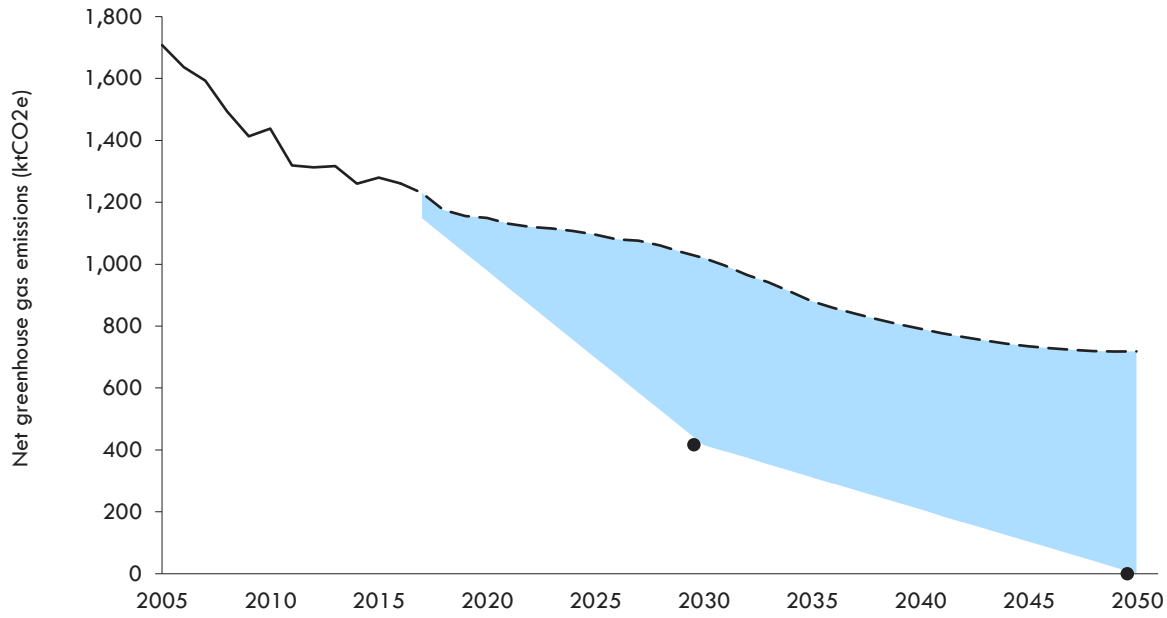
North West Leicestershire District Council



Zero Carbon Roadmap

Etude

North West Leicestershire District Council

November 2019

Contents

Important note

This report has been prepared for North West Leicestershire District Council. It includes recommendations relative to the reduction of carbon emissions towards Zero Carbon in 2030 (Council emissions only) and 2050 (District as a whole). It is important to note that these recommendations and comments have been made by Etude and have not been validated by North West Leicestershire District Council. They do not constitute official guidance or policy.

A growing environmental culture

North West Leicestershire District Council has set up and run a number of environmental initiatives in the past few years and they constitute the foundations of what needs to happen now to achieve Net Zero Carbon.

A step change to achieve Net Zero Carbon

North West Leicestershire District Council has already begun its journey toward net zero carbon emission by declaring a climate emergency and commissioning this report. Most emissions reductions to date in the district are due to the UK's electricity supply becoming cleaner through the replacement of coal fired electricity generation with wind turbines and solar panels, though the district has made good progress in deploying solar technology.

This study now proposes a more comprehensive series of actions across the key sectors of electricity generation, buildings, transportation and land use. These actions represent an increased ambition in the context of the climate emergency that is in line with scientific targets for greenhouse gas emission reductions.

These proposals must to be translated into real actions to make a difference, so if you have any questions about any of our proposals, please contact Etude on 020 3176 4464 or by email:

Anna Mac Kenzie: anna.mackenzie@etude.co.uk
Thomas Lefevre: thomas.lefevre@etude.co.uk

We will be happy to answer any questions on this Zero Carbon Roadmap.

Glossary

Acronym	Full definition
BECCS	Bio-energy with Carbon Capture Storage
BEIS	Department of Business, energy and industrial strategy
CCS	Carbon Capture and Storage
COP	Coefficient of Performance
CO_{2e}	Carbon Dioxide Equivalent
DEC	Display Energy Certificate
DSM	Demand Side Response
EPC	Energy Performance Certificate
EV	Electric Vehicle
GHG	Greenhouse Gas
HGV	Heavy Goods Vehicle
LCC	Leicestershire County Council
LGV	Light Goods Vehicle
MVHR	Mechanical Ventilation with Heat Recovery
MW	Mega-Watts, unit of power
NWL	North West Leicestershire
NWLDC	North West Leicestershire District Council
PV	Photovoltaic, electricity-producing solar panels

The climate emergency

The climate emergency and the Council's role in achieving Zero emissions by 2030 (Council's direct emissions) and 2050 (whole district)

The science is clear and there is a growing consensus that urgent action is required to mitigate climate change. The targets are to achieve a Net Zero Carbon Council by 2030 and a Net Zero Carbon District by 2050.

1.0 CLIMATE CHANGE

This section summarises briefly why the issue of climate change is so important and why urgent action is required. Although there are many initiatives required at the national level, local action is likely to be decisive if the UK is to set itself on the right path in the next 10 years to achieve Zero Carbon by 2050.

1.1 Climate change and the need for action

There is overwhelming scientific consensus that significant climate change is happening. This is evidenced in the latest assessment of the Intergovernmental Panel on Climate Change (IPCC AR5). Climate change is leading to rising temperatures and sea levels, causing extreme weather, damaging ecosystems, reducing the productivity of crops and changing the natural environment. Many impacts are already being detected globally. It is extremely likely that human activity is the predominant cause of climate change through emissions of greenhouse gases (GHG).

The IPCC special report published in 2018 on the impacts of global warming of 1.5 °C above pre-industrial levels[1] highlights the urgency for action and generated a high level of interest and concern in society as a whole.

1.2 A growing sense of urgency

1.2.1 International policy - The Paris Agreement (2015)

International negotiations on climate change are governed through the United Nations Framework Convention on Climate Change (UNFCCC). The most recent negotiations concluded with the Paris Agreement in December 2015. This Agreement reaffirms global ambition to limit temperature rises to below 2°C and binds every country to produce national plans to reduce emissions. The agreement also contains a further collective aspirational goal to reduce emissions in line with keeping the temperature increase to 1.5°C.

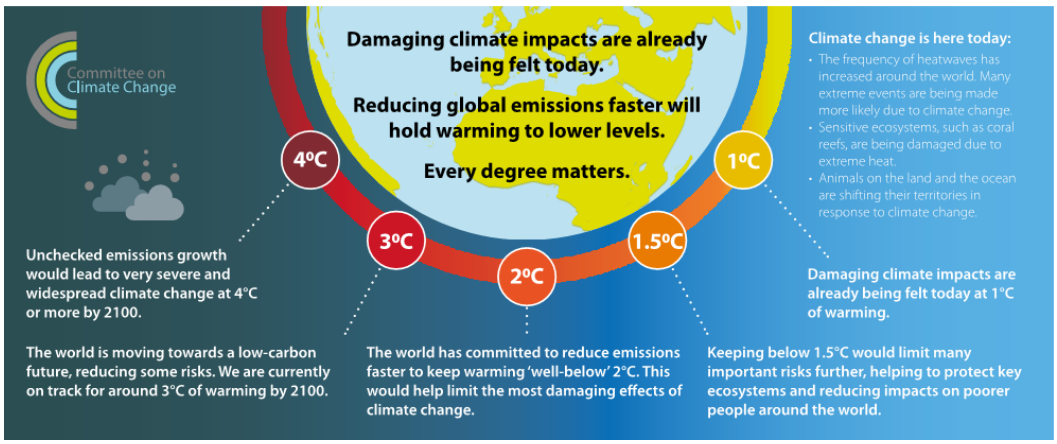


Figure 1.01 – Every degree matters. The need to limit global warming (© CCC)

1.2.2 National policy

The Climate Change Act 2008 commits the government to reducing the UK's carbon emissions by at least 80% by 2050 compared with a 1990 baseline. This target was advised by the Committee on Climate Change (CCC) as an appropriate share of global action to limit global surface warming to around 2°C above pre-industrial levels by 2100. The Climate Change Act requires the Government to set 5-year carbon budgets and to report against those. Within the overall strategy, targets are set for a number of key sectors of the economy and infrastructure of the UK. The strategy includes investment budgets as well as carbon targets. Overall, the Government has set an objective of reducing the carbon intensity of the economy by 5% a year until 2032.

The Clean Growth Strategy 'Greening Government' commits Central Government and its agencies to carbon emissions reductions targets. A voluntary target for the wider public and higher education sectors in England has

[1] Special Report on Global Warming of 1.5 °C (SR15), Intergovernmental Panel on Climate Change (IPCC), 2018

also been set. This target aims to reduce greenhouse gas emissions across these sectors by 30% by 2020/21, compared to a 2009/10 baseline.

The Committee on Climate Change recommendations

As a result of the Paris Agreement, the Committee on Climate Change[2] (CCC) has recommended that '*the UK should set and vigorously pursue an ambitious target to reduce greenhouse gas emissions (GHGs) to 'net-zero' by 2050, ending the UK's contribution to global warming within 30 years*'. The Government adopted the recommendation of this report and the Climate Change Act was amended in June 2019 to establish a legal requirement to achieve net zero emissions by 2050.

The CCC have also stated that achieving net zero '*is only possible if clear, stable and well-designed policies to reduce emissions further are introduced across the economy without delay. Current policy is insufficient for even the existing targets.*'

Another recent report from the Committee on Climate Change on housing[3] recommends that performance standards for new dwellings and their enforcement are tightened. In particular, it recommends '*ultra-low levels of energy*' for new dwellings[4].

1.2.3 Declarations of climate emergency

As of July 2019, 138 Councils (Unitary, County, Metropolitan, District, Borough, City) had declared a 'Climate Emergency' with many of them declaring a target date of 2030 for Zero Carbon. Although these declarations have not been translated into concrete actions yet, they appear to be laying the foundations for significant action to mitigate and adapt to climate change in the next 10 years.

Leicester City Council is one of the Councils that has declared a Climate Emergency. They have stated: "*By 2030, Leicestershire County Council wants to emit zero carbon from activities under our control*". To date, they have not published a detailed plan of action to achieve their target.

[2] Net Zero: the UK's contribution to stopping global warming, 2019, CCC
[3] UK Housing: fit for the Future?, 2019, CCC
[4] Equivalent to 15-20 kWh/m^2/yr. The latest CCC report to Parliament noted that there is no robust evidence to suggest that the introduction of new energy efficiency/low carbon heat standards for new homes would appreciably reduce or delay new housing supply to meet Government targets for new housing.

1.2.4 Civil society initiatives

A growing level of interest in climate change mitigation seems to be happening in society as a whole with the Schools Strike movement (created by 15-year old Greta Thunberg), radical action by activists from Extinction Rebellion and high-profile support from leading environmentalists like David Attenborough.

In particular, Extinction Rebellion have articulated three key demands:

1. ***Tell the truth.*** *Government must tell the truth by declaring a climate and ecological emergency, working with other institutions to communicate the urgency for change.*
2. ***Act Now.*** *Government must act now to halt biodiversity loss and reduce greenhouse gas emissions to net zero by 2025.*
3. ***Beyond Politics.*** *Government must create and be led by the decisions of a Citizens' Assembly on climate and ecological justice.*

A growing call for action at all levels is emerging.

1.3 North West Leicestershire District Council carbon commitments

Local plan

The North West Leicestershire Adopted Local Plan highlights that the CO_2 emissions per person in the district are substantially higher than the National average. Objective 8 of the Local Plan is to '*Prepare for, limit and adapt to climate change*'.

There are also references throughout the Local Plan to issues that are related to carbon emissions, although not always specifically referred to in those terms. For example, the development of transport infrastructure is a key issue for the District, for economic growth, for air quality and also for mitigation of carbon emissions.

Climate local commitment

North West Leicestershire District Council (NWLDC) signed the Climate Local Commitment on 19 December 2014. In signing the commitment, the Council committed to set locally-owned and determined targets and actions on both mitigation and adaptation and publish these within six months. A number of priorities, commitments and actions were set. NWLDC also committed to monitor the Council's performance against these actions and report regularly on progress.

Motion of climate emergency

The following motion was adopted by the council on 25th June 2019:

a. That this Council notes:

   i. the UK has, at international level, signed into the Paris Accord 2015 and to the commitments agreed in 2018 at the Conference of Parties to the UN Framework Convention on Climate Change (COP24) which amongst other things recognise the need to limit by 2030 temperature rises to between 1.5° C and 2° C above the internationally recognised preindustrial baseline;

   ii. the UK has at a national level, set targets into law under the Climate Change Act 2008, but despite outperforming every G7 nation by cutting emissions by more than 40 per cent since 1990, and recently breaking the record for the longest continuous period without using coal in the energy mix since the Industrial Revolution, the UK is not currently on track to meet its statutory carbon targets set in the 4th and 5th carbon budgets for the period 2023-2027 and 2028-2032 respectively;

   iii. **This Council already demonstrates its public commitment to the environment through the Green Footprints agenda which includes a Free Tree scheme, efforts to increase recycling and making Council homes more efficient by installing air source heat pumps**.

b. That this Council further notes that in October 2018 the UN Intergovernmental Panel on Climate Change (IPCC) published scientific evidence and determined that any rise above 1.5°C would cause much more serious outcomes than Paris Accord envisaged, thereby having a more rapid adverse impact in the north and south polar regions and the Himalayan 'third pole' and in doing so recognises that the current efforts and targets towards reducing emissions and limiting temperature rises is clearly not enough.

c. That this Council also notes that there are increasing calls for councils to declare a climate emergency and to commit to carbon neutrality by 2030 for their administrative areas.

d. That this Council notes that:
   i. it can only operate within its own scope of control and influence;
   ii. there is a need to balance the competing demands on its decreasing resources and finances;
   iii. not all the technological solutions nor the required powers and resources are currently in place.

e. That **this Council declares a climate emergency and will aim to achieve carbon neutrality from its own operations by 2030 and accordingly requests officers to develop an environment strategy necessary to achieve this aspiration together with an assessment of the cost and technology implications** of so doing to enable the Cabinet and Council to take an informed decision whilst recognising that this will potentially require the reallocation of resources by the Council.

f. **That this Council commits to work with business and other public bodies across the district county** and region to deliver this ambitious goal through all relevant technologies, strategies and the revision of the Local Plan where this aligns with national policy and guidance.

g. **That this Council recognises that there is an increasing urgency for action** to avoid the worst impacts of climate change and in doing so calls for the support of all parties to urge the Government to:
   i. provide the powers and resources to local authorities and others to make the wider 2030 target more possible;
   ii. work with other governments (both within the UK and internationally) to determine and implement best practice methods to limit global warming to less than 1.5°C above pre-industrial levels.'

1.4 Recommended targets

1.4.1 Setting the ambition

The various councils in the UK that have declared a Climate Emergency have in many cases opted to set a target for net zero carbon in their regions at some date in advance of the national target date of 2050 recommended by the CCC.

Setting a target which is consistent with the national context is a reasonable and justifiable Science-based approach, and it does not preclude reaching the target ahead of the deadline.

Therefore, our first recommendation is for the Council's operations to be reduced to Net Zero Carbon by 2030.

Our second recommendation is for North West Leicestershire as a whole to achieve Net Zero Carbon for all emissions by 2050 and to try to achieve it before that date if possible[5].

1.4.2 Defining Zero carbon

'Zero carbon' is a phrase used frequently in Climate discussions. It sounds like a simple concept, but in fact it needs to be defined in terms of exactly which sources are included and which measures for off-setting carbon emissions are allowed. Net zero carbon does not mean there will be no CO_2 emissions; there will be emissions and these will be 'off-set' by either a reduction in carbon outside the measured area, or by a form of sequestration of carbon dioxide.

1.5 Beyond carbon: co-benefits

This report focuses on carbon emissions, their sources and how to reduce them. It should not be considered as an environmental strategy which addresses wider issues such as air quality, flood risk, water management, etc. However, it is clear that a number of initiatives recommended will have important co-benefits from an environmental and health point of view. For example, accelerating the transition towards low emission cars and transport is likely would have benefits in terms of air quality.

[5] The CCC Net Zero Carbon Report also identifies a target greenhouse gas emission per person globally of less than 1.7 tonnes CO_2 per year by 2050. This 'individual' target approach could be used for North West Leicestershire but it would require further work to ensure that it is both appropriate and ambitious.

2.0 THE CASE FOR ACTING NOW

The case for beginning action now is clear and simple:

- A change in direction is imperative – waiting holds no benefits, delays returns and compounds the problem.
- The consensus from the Committee on Climate Change and others is that this is our last chance to take the bold actions that are needed.
- NWL can get a head start in creating new markets and developing much needed skills.
- The sooner action is taken, the greater the overall reduction in emissions.
- Pipeline and lead-in times – industry will need to scale up to meet the demands of a zero carbon economy. This may mean waiting lists and supply and demand issues, the impacts of which will be eased through immediate action.

"Reaching net zero carbon emissions by 2050 is achievable. However, this requires immediate action across all key technologies and policy areas."

National Grid
Future Energy Scenarios, July 2019.

"It is still not too late to act. It will take a far-reaching vision, **it will take courage**, it will take fierce, fierce determination to act now, to lay the foundations where we may not know all the details about how to shape the ceiling. In other words, it will take cathedral thinking."

Greta Thunberg

"Delivery of greenhouse gas emission reductions must progress with far **greater urgency**"

Committee on Climate Change
"Net Zero" Report, May 2019

"If we don't take action, the collapse of our civilizations and the extinction of much of the natural world is on the horizon"

David Attenborough

Where are we?

Quantifying carbon emissions in North West Leicestershire

This section provides an estimate of NWLDC's current carbon emissions and where a 'business as usual' scenario is likely to take us.

3.0 HOW DO WE MEASURE CARBON EMISSIONS?

Greenhouse gas emissions result from almost everything we do. It is important to understand how these emissions are categorised so we can track progress toward net zero.

3.1 Committee on Climate Change categories

The Committee on Climate Change (CCC) is an independent body formed to advise the government on tackling and preparing for Climate Change. The CCC have set up a very useful framework for categorising emissions on a sector by sector basis. The sectors considered are:

- Power
- Industry
- Buildings
- Surface Transport
- Agriculture
- Land-use, Land Use Change and Forestry (LULUCF)[6]
- Waste
- F-gas emissions[7]
- Aviation and Shipping
- Hydrogen production

3.2 Greenhouse Gas Protocol

Greenhouse gas emissions are categorised by the Greenhouse Gas (GHG) Protocol, which was established in the late 1990's as a response to the need for a consistent global approach to GHG accounting. The Protocol is the most widely used international GHG accounting tool. It establishes three categories of emissions:

Emissions scope	GHG Protocol Definition	Considered in this report
Scope 1	Fuel combustion, company vehicles and fugitive emissions from F-gases	Gas for heating, fuel for council vehicles
Scope 2	Purchased electricity, heat and steam	Purchased electricity
Scope 3	Purchased goods and services, business travel, Employee commuting, waste disposal, use of sold products, transportation and distribution (up- and downstream, investments, leased assets and franchises	Emissions associated with *rail / bus / air travel*, *suppliers/contractors travel*, *employee commuting*, and *waste disposal* were excluded due to lack of data.

Table 10.01 – GHG Protocol emissions categories considered in this report

NWLDC has already undertaken work[8] to quantify its emissions under the GHG Protocol, and identify emissions that are too difficult to track, or too far out of control of the Council. This report primarily focuses on achieving net zero carbon on the basis of reducing Scope 1 and Scope 2 emissions, which are within the Council's control. Reducing Scope 3 emissions can be challenging as many occur outside of NWL and even the UK. Often, they may only be reduced by reducing consumption or decarbonisation of the entire supply chain for products and services.

This report has adopted these same sectors to provide consistency with the CCC's work and relate to national progress in the future. Table 10.02 compares the CCC's sectors to the GHG Protocol emission categories. Scope 3 emissions are also indicated for buildings that the council own but do not control.

[6] Land use and land use change and forestry covers the net balance of emissions that arise from land use. For example, deforestation can reduce amounts of carbon sequestration by trees and some forms of agriculture can result in greenhouse gas emissions.

[7] F-gases or Fluorinated gases are man-made gases that can stay in the atmosphere for centuries contributing toward the greenhouse effect. They are sometimes used in refrigeration and air conditioning equipment.

[8] North West Leicestershire District Council (2015) *Report on Greenhouse Gas Emissions from Local Authority Own Estate and Operations 2014/15 for DECC*

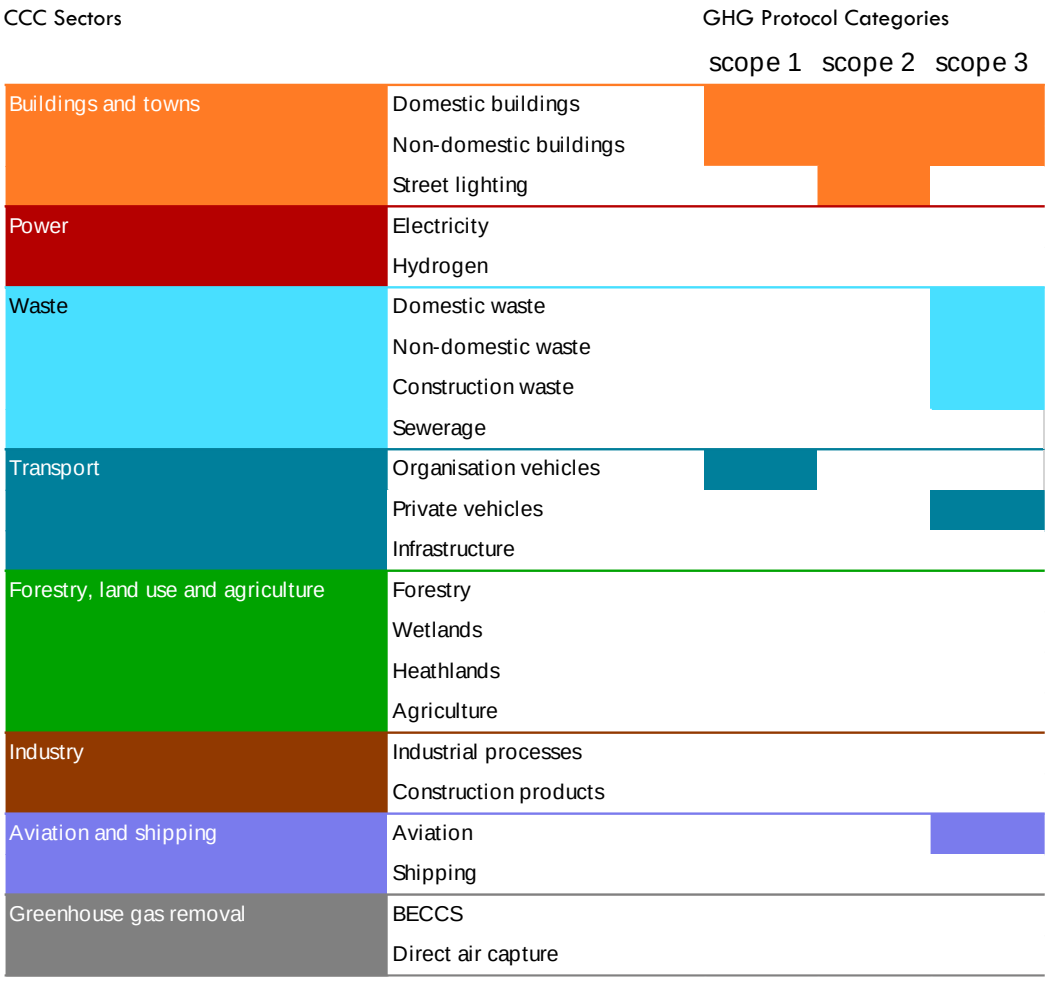


Table 10.02 - Comparison of sectors included in CCC report and LA reporting scope

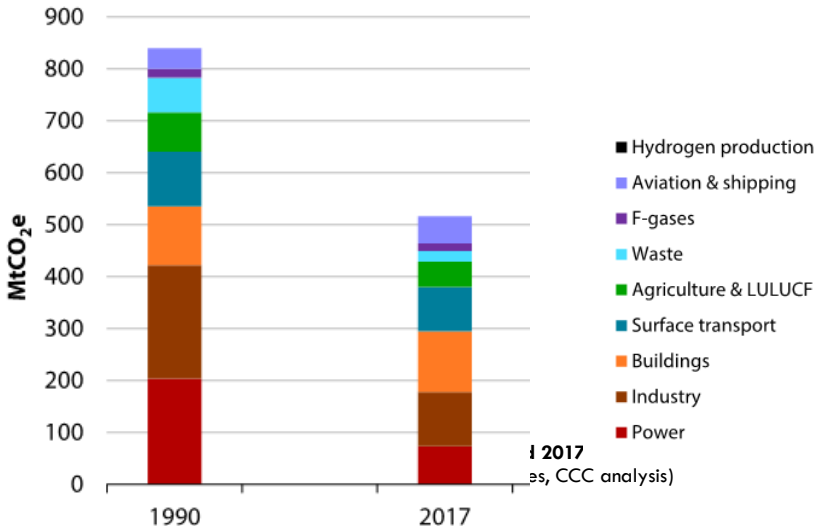
4.0 QUANTIFYING CARBON EMISSIONS

In order to respond to the challenge of climate change we must understand the sources of greenhouse gas emissions that are fuelling it.

4.1 UK National Emissions

The Committee on Climate Change's most recent report, "Net Zero: The UK's Contribution to Stopping Global Warming", May 2019, sets out a pathway to phase out greenhouse gas emissions by 2050 to end the UK contribution to global warming.

Since 1990 levels the UK has reduced greenhouse gas emissions by approximately 42%. This has been driven largely by a move away from coal to gas for the generation of electricity, and also a reduced demand from business and industry.



Fi **l 2017**
(S es, CCC analysis)

4.2 North West Leicestershire

A baseline year of **2016** has been adopted in the assessment as it is the latest year for which full emissions reporting is currently available. Years relate to the emissions recorded at the end of the year. For more information on the methodology we have used, please turn to the Appendix A.

4.2.1 Council direct emissions

The GHG emissions from North West Leicestershire District Council's own operations and assets have been assessed and calculated at just 1.5% of the total emissions from the district[9]. This figure is arrived at by estimating all emissions from Council owned assets. Emissions are assigned by user rather than by emitter, so for buildings emissions arising from gas consumption and electrical generation are assigned to the building.

Generally, the number and type of asset is known. for example; detailed information on the types of vehicle and building, however actual usage data has not yet been provided. Where information is missing national averages, for example domestic mileage and energy consumption by house, have been used. The UK Government GHG Conversion Factors for Company Reporting 2018 have been used for all carbon emissions factors.

Figure 4.02 – Total annual greenhouse gas emissions from North West Leicestershire District Council in 2016[10].

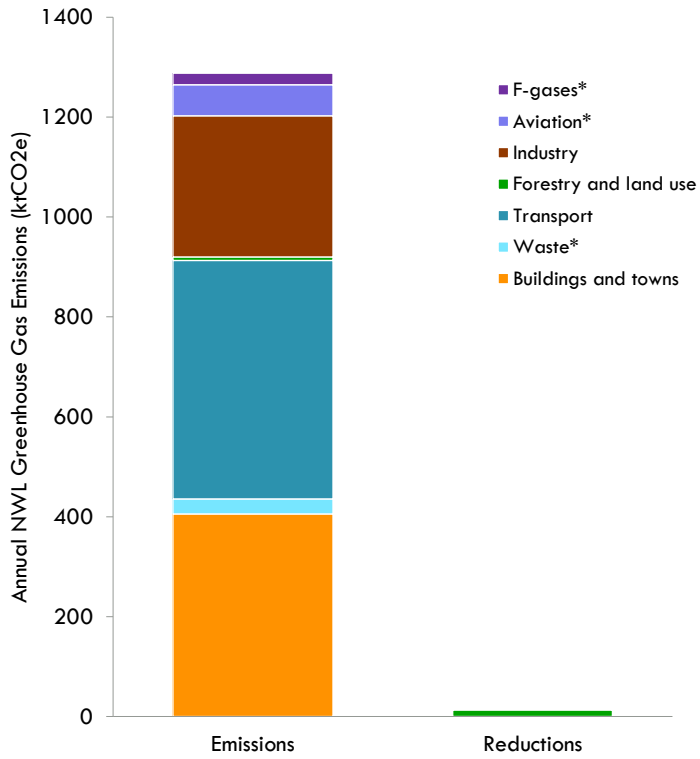
[9] As of 2017, this was approximately18 $ktCO_{2e}$

[10] The CCC categories have not been applied to this graph to enable a more detailed breakdown of the Council's emissions to be displayed.

The Council emissions are dominated by the buildings owned and operated by the Council, in particular housing. In this case the Council is the landlord and so responsible for the maintenance and improvement of the building stock. Although not directly responsible for heating a tenant's home or paying energy bills, the Council is directly responsible for upgrading the property. While tackling the emissions from the council's own operations is an imperative, the scale of emissions from the remainder of the district, presented in the following pages, shows how important it is for the council to show leadership in tackling wider district emissions.

4.2.2 District total emissions

To understand better the sources of GHG emissions from North West Leicestershire as a whole, we have reviewed data from district and county sources, central government sources and, where necessary, have made informed assumptions. Total estimated annual greenhouse gas emissions for North West Leicestershire in 2016 are shown in Figure 4.03[11]. The total compares favourably with BEIS reported emissions[12] for the district. The largest emitters are transport, buildings, and industry.



* Emissions calculated from share of UK emissions based on population.

Figure 4.03 – Total annual greenhouse gas emissions from North West Leicestershire in 2016 by sector

We have included an allowance for the share of national emissions from aviation, F-gases and waste (these are usually excluded from sub-national emissions reporting – however we think it's important to show them in this analysis to give a complete picture).

4.2.3 District features affecting carbon emissions

For context, we have compared the per capita GHG emissions of NWL to Leicestershire county and the UK as a whole. In order to be able to do this we have removed the allowance for aviation, f-gases and waste. **The per capita emissions for NW Leicestershire in 2016 were 11.7 tCO_{2e}/person**, compared to **6.6tCO_{2e}/person average in Leicestershire**, and **5.6tCO_{2e}/person in the UK.** Differences are likely due to district specific context, described below.

[11] A total of 1,281 $ktCO_{2e}$ was estimated for 2016, similar to BEIS reported emissions for North West Leicestershire of 1,153$ktCO_2$ (in 2016).
[12] Local authority Carbon dioxide Emissions estimates 2016 (BEIS), 2018

Sector for NWL emissions	NWL context
Buildings and towns	Domestic emissions in the district are regionally and nationally high. NWL is a substantially rural district, with a number of small towns and villages and relatively low population density (80% of the UK average). More than half of the area of the District falls within regions that have some degree of protected status; the National Forest, Charnwood Forest, and the River Mease SAC. Housing is predominantly owner occupied in NWL (around 75%) with a regionally high proportion of detached properties and a nationally very low percentage of high-density housing.
Power	The district has a similar amount of renewable energy generation to the UK average, though there is far more solar generation than onshore wind generation in NWL.
Waste	Household waste recycling rates in the district are close to the national average.
Transport	Transport emissions are higher than most neighbouring districts but regionally (Midlands) consistent: there are major quarries, distribution networks and roads. According to census data, the proportion of people who travel to work on any mode of public transport is half that of the East Midlands generally and around 20% of the National average. Private car use is the dominant mode of transport for commuters, almost 70% compared to 60% regionally and 55% nationally. The average distance travelled to work is a little higher than the national average – 14.5km vs 13.5km. Cycling and walking rates are close to the regional and national averages.
Forestry, land use and agriculture	The LULUCF emissions (net sequestration) rate for the district is consistent with the Midlands districts and with England overall.
Industry	Industrial emissions in the district are regionally high. Employment in the district is predominantly in manufacturing – over 20%. Which is a high proportion relative to the national average, which is less than 15% and in wholesale and logistics which are close to the national average. Mining and quarrying in the district is a much larger employer than regionally or nationally but it is a small sector overall.
Aviation and shipping	-
F-gases	-

Table 4.01 – District context and features affecting GHG emissions, by sector

5.0 FORECASTING FUTURE EMISSIONS

We have made forecasts of what the Council's and District greenhouse emissions might look like in the future, from 2016 to 2050, and compared these to the reductions necessary to achieve net zero.

5.1 Council direct emissions

For the Council there are currently very few significant policies that are likely to result in carbon emission reductions for the Council operations and buildings beyond changes in the district. In this section the district as a whole has therefore been used to show a 'business as usual' case. The projected scale of reductions shown for the district is likely to be similar for the Council.

5.2 District total emissions

Detailed forecasts have been carried out for the district as whole to show the scale of change. Figure 5.01 shows a forecast for the whole district of a likely scenario based on the current changes and policy already in place.

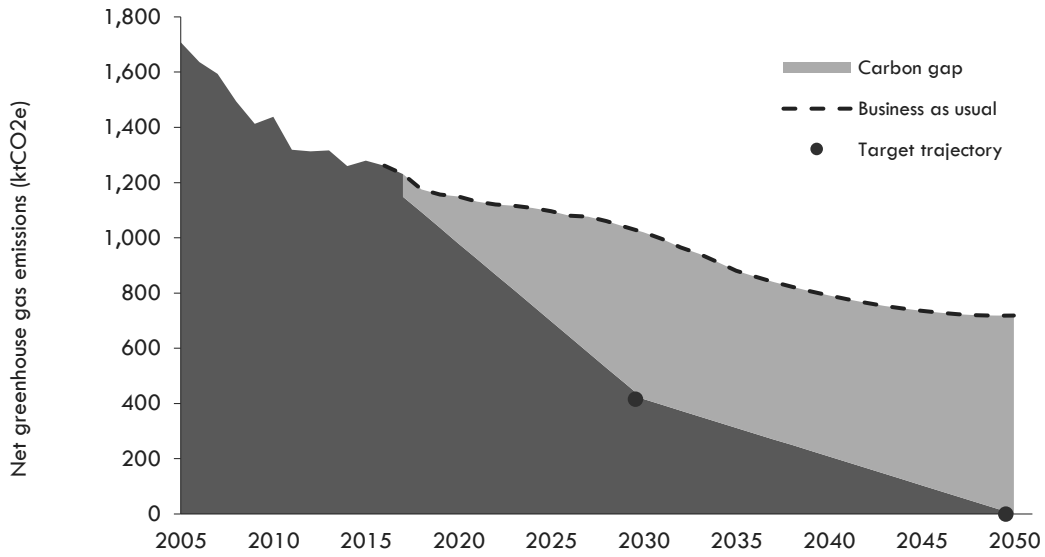


Figure 5.01- Forecast greenhouse gas emissions in NWLDC showing the carbon gap between an estimated current trajectory and what is required to achieve net zero carbon.

The historic emissions are shown, and then two scenarios developed into the future:

a. **Business-as-usual scenario**, which estimates a potential scenario if no intervention were made by the Council. This looks at current market and national policy trends along with the National Grid projections for electricity carbon factors. It factors in projected changes to population and assumes road and rail transport fleet increases by 34%[13], with slow uptake of electric vehicles. New housing needs are assumed to increase in line with the NWLDC Local Plan[14], with housing built to current building regulations and slow uptake of electric heating. No meaningful refurbishment of existing buildings is assumed. Emissions from heavy industry in NWLDC are estimated to reduce by 30% due to changes in provision and efficiencies in current plant.

b. A notional **net zero carbon trajectory**, with targets for 2030 and 2050.

The graph shows that there is a significant shortfall in the current trajectory for the district, which reflects the picture nationally. **We estimate only a 40% reduction** is likely to be achieved by 2050, and this could be much less if national initiatives are not acted on. Greenhouse gas emission reductions in the business as usual case are almost entirely made in the power sector, mainly outside of North West Leicestershire. See Section 11 – 'decarbonising electricity' for more detail. Any savings from buildings and transport are almost solely due to the reduction in carbon content of electricity. Contribution from improvements in building efficiency and changes in transport are negligible.

5.3 Methodology and assumptions for emissions forecasts

Forecasting and accounting for GHG emissions is highly complex, and there are multiple valid ways to look at the problem. Our approach has been to focus on capturing all emissions in the district, and to use available public data and Council information to estimate the breakdown for different sectors. The aim of this is to allow the Council to prioritise and focus efforts on where the largest reductions are required. Detailed information on the methodology for forecasting emissions has been included in Appendix F. The headline assumptions are shown below.

Category	*Assumption - 2050 Business as usual*
Decarbonisation of electricity	Carbon content of electricity falls rapidly in line with Government projections.
Residential building energy efficiency	No major changes to current Part L minimum requirements. 80kWh/m²/yr heating energy demand achieved on average.

[13] Department for Transport. Road Traffic Forecasts 2018 Moving Britain Ahead gives road traffic growth forecasts of between 17 and 50%, the median growth forecast is taken.
[14] NWLDC Local plan Appendix 2 Housing trajectory as of 1/10/2016

Non-residential building energy efficiency	10% reduction in commercial heating energy through energy efficiency and changes in sector.
Building heating	Market led switch to heat pumps means modest take up, 50% of properties are still on gas in 2050.
Industrial efficiency	30% improvement in industrial efficiency or change in sector reduces emissions.
Industrial heating	Industrial processes remain mainly combustion based
Electrification of transport	Market lead switch to electric cars. 50% of vehicles on the road are electric or hydrogen by 2050
Aviation	National aviation growth projections used. Broadly offset by improvements in efficiency
Forestry & land use	No meaningful additional forestry or change in agriculture
F-gases	EU targets for F-gas reductions are kept as UK law and met

Table 5.01 – Headline assumptions for business as usual greenhouse gas emissions forecasting

Reductions for buildings and transport are the most likely to be bespoke in the district and contribute a large proportion of emissions. These have been calculated from a 'bottom up' analysis of changes in stock and use. Where less is known about the source; the reduction forecasts from the Committee on Climate Change (CCC) Net Zero UK report have been used. Emissions that occur locally, but contribute to the national economy, such as industry and aviation have been shared between local authorities using population.

A pathway to Net Zero

How to reach net zero emissions

Recommended actions to reduce carbon emissions to Zero by 2030 (Council emissions) and 2050 (District as a whole).

This section summarises the key recommended actions and forecasts their effect in the next 30 years. This constitutes the 'Zero Carbon Roadmap' for North West Leicestershire District Council.

6.0 ZERO CARBON PATHWAYS AND THE FORECAST MODEL

Etude has developed a forecast model to project the impact of various courses of action by the Council. We have used this model to show the current likely trajectory, and to test what changes would be needed for the Council to achieve net zero carbon emissions by 2030, and the district as a whole to achieve net zero emissions by 2050.

6.1 Forecast model methodology

A range of potential policy changes, direct actions, and Council outreach measures have been considered. The intended outcome of each is translated into a measure for each sector. Each measure is given a start and end date for adoption, a profile for take up, a maximum potential improvement and a maximum level of adoption.

Parameter	*Description*	*Example*
Start and end date	The period that the maximum levels of potential improvement and adoption are assumed to have occurred over.	*By 2030 all buses will be electric*
Change and profile for take up	The rate at which an action is adopted and how this changes over time	*The fleet will be replaced in two phases with replacement in 2025 and 2030.*
Maximum potential improvement	The maximum technologically possible for the action	*Electric vehicles achieving 15kWh/100km*
Maximum level of adoption	The maximum take up of the technology that is assumed	*60% of journeys are by electric vehicle*

Table 6.01 - Logic for including adoption of actions in forecast

For each measure a 'business as usual', low and high assumption has been estimated. These are used to give a low and high emission scenario respectively. The forecast shown here uses a high assumed uptake for each measure to show the maximum realistic reduction in carbon emissions with existing technology.

The potential change in emissions from any given policy or action has been estimated based on guidance provided by the GHG Protocol[15]. This approach generally involves four steps:

1. **Estimating baseline emissions**
2. **Clearly defining actions**

   These are based on our prior knowledge of the sector, research into local factors affecting that sector, identification of planned projects or any other local context that may make an action or policy more likely to succeed. Policies or actions may be independent, overlapping, reinforcing, or overlapping and reinforcing.
3. **Identifying GHG emission effects, mapping the causal chain and defining effect boundaries**

   The effect of each policy or action on GHG emissions is considered broadly, including knock-on effects that may occur through a 'causal chain', and the boundary of the effect. For example, as the UK's electricity supply becomes cleaner, it could influence the uptake of electric heating systems while reducing building regulation incentives to install solar panels.

   Long-term effects are considered such as growth of a technology sector. Source and sink effects are also considered, for example, a source may include increased traffic emissions and a sink of CO_2 may include reforestation. The effects are then assessed for likelihood and magnitude to determine their inclusion in the assessment.
4. **Estimating the effects**
   The effects of each action have been tested in the Etude carbon emissions forecast model. For changes to buildings, infrastructure and transport we are able to calculate the likely potential change from bottom up analysis, for example change each building, or based on forecasts from Government departments.

A full description of the methodology used to calculate emissions from each category is included in Appendix F.

[15] GHG Protocol (2019) *Policy and Action Standard*

6.2 Forecast model key assumptions

Table 6.02 summarises the key assumptions for each measure. In general, the same assumptions for the Council stock and the district as a whole have been assumed, apart from where noted.

Sector Category	*Assumption used for zero carbon pathway*
Decarbonisation of electricity	Carbon content of electricity falls rapidly in line with Government projections. Carbon content of electricity is 0.085 $kgCO_{2e}$/kWh in 2030 and 0.030 $kgCO_{2e}$/kWh in 2045.
Residential building energy efficiency	All new homes built after 2020 achieve Passivhaus or an equivalent standard. 15kWh/m^2/yr heating energy demand achieved on average. (No new Council homes are built)
	80% of existing homes have a complete low energy retrofit by 2050 (by 2030 for Council homes). A bespoke target heating energy demand has been assigned by house type for bungalows, terraces and semi-detached, flats and detached homes using the AECB CLR[16] recommendations. This gives an approximate average achieved heating energy demand of 40kWh/m^2/yr.
	3% of existing buildings are demolished and replaced with new build by 2050. This is approximately 1,400 homes over the whole period.
	Electrical efficiency of appliances continues to improve but is offset by increased use. A net 10% improvement is achieved between 2020 and 2050.
Non-residential building energy efficiency	90% reduction in commercial gas consumption through electrification and energy efficiency.
	10% net consequential increase in electrical consumption. The majority of the increase from electrification is offset by improved efficiency and use of commercial heat pumps.
	Full retrofit of Council offices to achieve a heating demand of 40kWh/m^2/yr and net zero carbon through the switch to low carbon heating (heat pump) and a solar PV installation.
	New leisure centres achieve a 90% reduction in carbon emissions.
	All Council owned non-domestic properties are refurbished on change of lease. Achieve 50% carbon emission reductions.
Building heating	Gas boilers are phased out by 2035. Residual 3% of buildings use gas. (All Council buildings are assumed to be off gas by 2030).
	All building heating is provided by a heat pump with COP of 2.6, or an equivalent low carbon technology (for example hydrogen fuel cell, or waste industrial heat). No buildings are heated by on-site combustion.
Electrification of transport	Fleet and number of journeys grow by 34% through to 2050.
	99% of domestic and light goods mileage is completed by electric vehicles or equivalent by 2045. (All Council vehicles are electric by 2030). Electric vehicles achieve an average efficiency of 30kWh/100miles.
	HGV emissions reduce by 50% through reduced journeys, switch to rail, and developing hydrogen or electric drivetrain technologies.
Reducing waste	64% reduction in emissions from waste in line with 'further ambition' recommendations by CCC[17].
Industrial efficiency	53% reduction in industrial emissions or changes in sector reduces emissions. This is in line with the 'core' recommendations by CCC[17].
Aviation	8% increase in emissions. Uses national aviation growth projections which are broadly offset by improvements in efficiency. Note aviation emissions are calculated from NWL's population and use of air travel, not from emissions arising from East Midlands airport (which are considerably higher).
Forestry & land use	22% increase in carbon reductions from forestry due to reforestation and change in land use.
F-gases	EU targets for F-gas reductions are kept as UK law and met.

Table 6.02 – Assumptions used in forecast model

[16] AECB Carbonlite Retrofit course. Predicted in-use energy calculations for a range of different house types were used to recommend a series of heating energy consumption targets for different house types.
[17] Net Zero: The UKs contribution to stopping global warming (The Committee on Climate Change), 2019

6.3 Council zero carbon pathway

The Council is targeting net Zero Carbon by 2030. Required changes to the Council operations have been modelled using the emissions forecasting tool to estimate the reduction in GHG emissions that would be achieved. The total Council emissions in 2016 and 2030 are shown below. **It is estimated that an 87% reduction in emissions is possible, taking Council emissions from 18ktCO_{2e} down to less than 2.2ktCO_{2e} in 2030.** The remaining emissions would need to be offset by Council through investment in forestation, change in land use or other technology that removes atmospheric carbon.

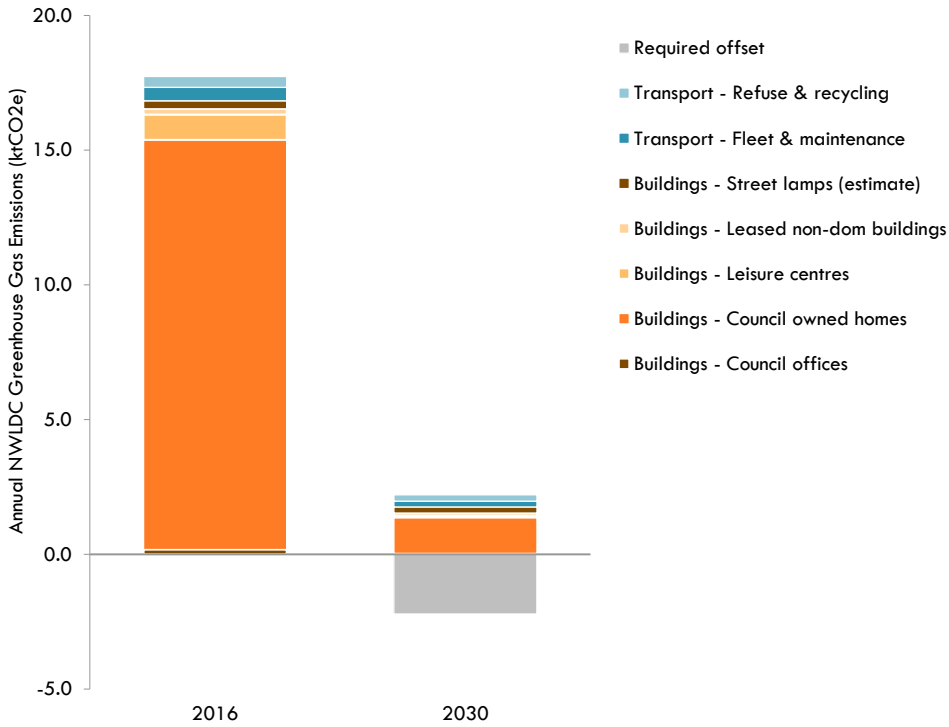


Figure 6.01 – Total annual greenhouse gas emissions from North West Leicestershire District Council in 2016 (estimated) and 2030 (projected) by end use

The most significant changes are required to the Council building stock. This relies on refurbishment to radically improve the energy efficiency of buildings, and a complete switch to heat pumps as a heating technology.

The estimate assumes that 80% of Council homes, all major non-domestic assets, and 80% of minor assets are refurbished before 2030. The refurbishment would achieve a reduction in heating energy of 75% on average for each home through a range of whole house measures in line with the recommended potential for different house types suggested by the AECB Carbonlite Retrofit programme[18].

Dwellings and non-residential buildings would also move to a low carbon heat source. Electric heat pumps have been used in the calculation as they are a proven, future proof and readily deployable technology. However, any alternative technology achieving the same reduction in carbon emissions per kWh of heat generated could be considered. The estimate assumes that over 70% of heating across all buildings is provided by heat pumps by 2030, and that all remaining coal and oil heating is phased out before 2025.

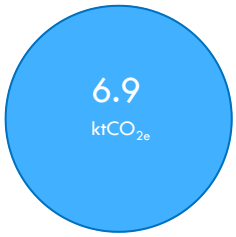
6.3.1 Importance of a comprehensive approach

[18] AECB Carbonlite retrofit programme research output provided by the AECB for use in this study. See website for further details. https://www.aecb.net/knowledgebase/

To become a Net Zero carbon Council our calculations show that large contributions from all departments and assets are required. Even with all contributions a substantial amount of offset is required.

Small deviations from the actions recommended in this report may result in large overshoots of the net zero target. As an example, allowing just 10% of council buildings to retain gas heating would triple the Council's total emissions in 2030 and require 10,000 hectares of trees to offset. This would not be feasible as trees are already assumed to be planted on all suitable land.

Total Council emissions requiring offset in 2030 assuming high uptake of heat pumps



Total Council emissions requiring offset in 2030 assuming reduced uptake of heat pumps

Finding offset and carbon reduction for 2200tCO_{2e} per year is already a very challenging and difficult task. The additional reductions required from not maximising the savings available is highly likely to put net zero carbon out of reach for NWL District Council.

6.4 District zero carbon pathway

A pathway for the district as a whole to achieve zero carbon by 2050 was developed by modelling required changes using the forecast tool. This gives a pathway towards net zero carbon and shows the contribution required from each sector.

The pathway shows that very significant reductions are possible, far below the business as usual case, but that full net zero carbon is dependent on technology or further reductions that are not yet known. What is certain is that to achieve this trajectory and to put zero carbon within reach, the changes needed are very significant and action is required in all sectors.

Close to 200ktCO_{2e} of additional reduction or offset would be required in the Zero Carbon scenario shown. Some of this could be from further reduction in some sectors (for example aviation and road transport), some could be provided by sequestration from large scale reforestation, however a significant part is a technology gap. For example, emerging Carbon Capture and Storage (CCS) technology would be required.

The speed of emission reduction changes is very important. Another way of thinking of carbon emissions is as the speed at which a finite carbon emissions budget is used up. By acting faster and saving emissions sooner with technologies that already exist, we have longer to develop the future savings that will be required.

The carbon pathway is a good visualisation of the rate of change and the contributions to carbon emissions from each sector but does not tell the complete story. Some changes that are very important to practically achieving transition to a low carbon economy are not fully represented. For example, residential building energy efficiency is a relatively minor part of the building efficiency sector contributions, however, is necessary to be able to achieve the decarbonisation of heat savings also shown on the graph.

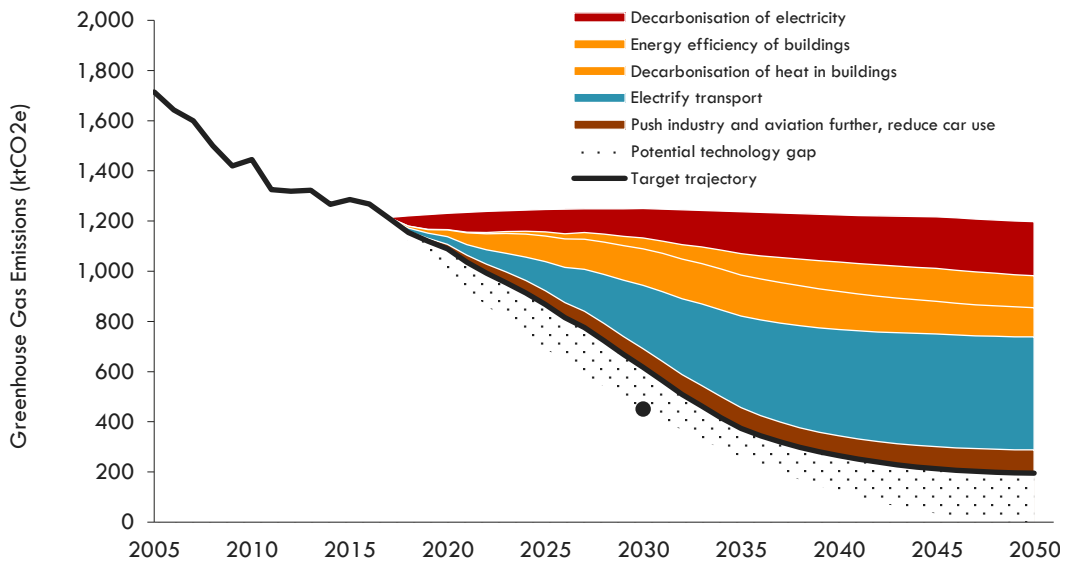


Figure 6.02 - Carbon pathway for the whole NWL district showing the contribution to reduction from each sector, and the potential technology gap for carbon reduction that is required.

The estimated breakdown of emissions by sector in 2050 is shown below in comparison to the current and business as usual emissions. In the zero-carbon scenario shown we have assumed emissions from aviation remain relatively constant, with growth offset by improvements in efficiency. By 2050 it can be seen that this is 35% of the district's total emissions. Reduction in flying at a national level would significantly reduce the pressure on other industries to deliver emission savings.

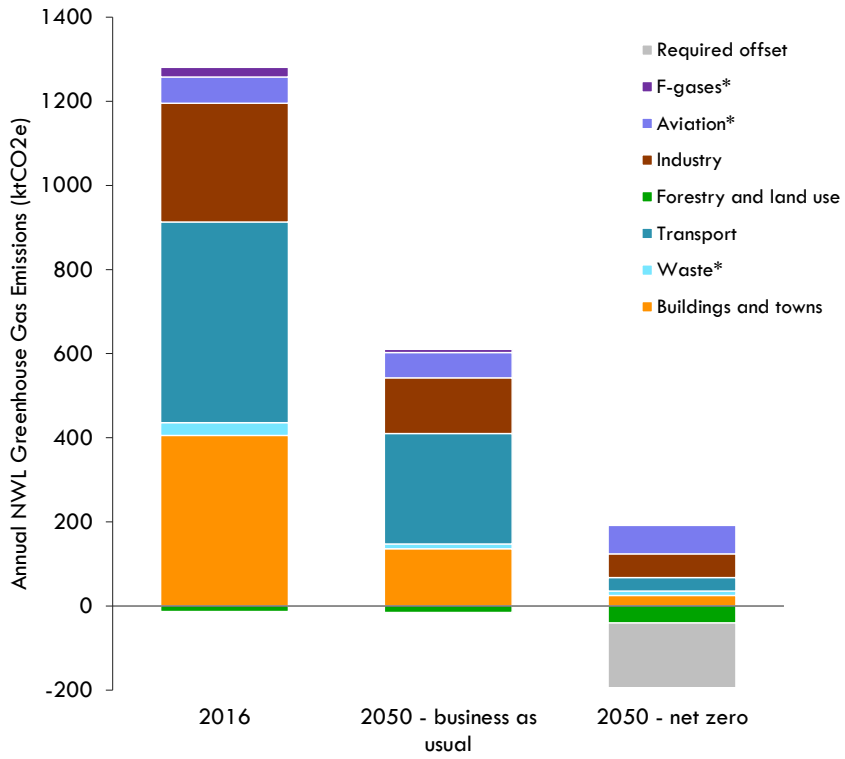


Figure 6.03 – Total annual greenhouse gas emissions from North West Leicestershire in 2016 (estimated) and 2050 in projected business as usual and net zero scenarios by end use.

7.0 THE COUNCIL'S ROLE IN ACHIEVING NET ZERO

To achieve the target of the UK reaching net zero GHG emissions by 2050 we all have a role to play.

The first step we have taken to considering how to tackle the Climate Challenge and reduce GHG emissions to zero in North West Leicestershire is to consider the levels of control and influence that the council has.

Municipal responsibilities are split between local parishes at the smallest scale, town councils, the district council and the county council. Overarching all of this is national policy imposed by central government. The programmes, policies and laws established by both local and national government influence the actions of residents and organisations across the entire district.

The shift to zero carbon by 2050 in North West Leicestershire will be driven by different parties and factors.

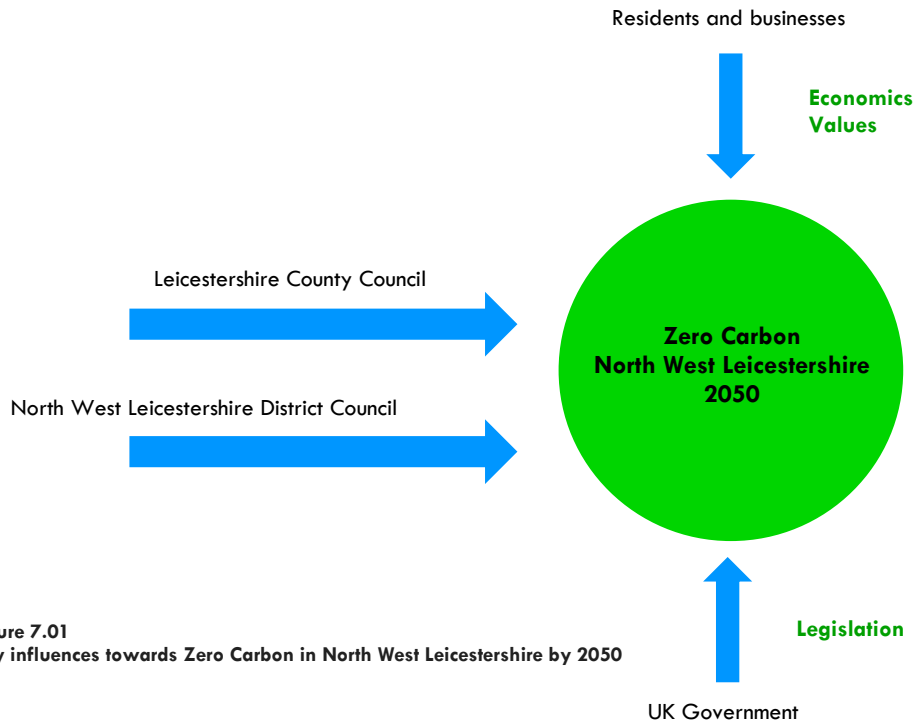


Figure 7.01
Key influences towards Zero Carbon in North West Leicestershire by 2050

8.0 TARGETS TO REACH NET ZERO

Key targets for the district of North West Leicestershire to reach net zero GHG emissions are summarised on the following pages, organised by sector. The approach and sectoral targets follow closely those used by the CCC in their net zero carbon report[19].

Sector	Interim Targets	2050 Target	Notes
Buildings and towns	**2020** to end use of fossil fuels in new homes (e.g. gas boilers) **2030** for all new construction to be net zero carbon **2030** for 25% of existing buildings to be heated from low-carbon sources **2035** for all homes to be EPC Band C or better **2040** for 50% of existing buildings to be heated from low carbon sources.	100% of buildings to be heated from low carbon sources.	
Power	**2021** for all new build warehouses and business units to be required to have PV systems **2021** for all new residential developments to include PV systems **2025** for solar PV generation in NWL to be increased to 120MW (from 89 MW currently) **2030** for onshore wind generation in NWL to be increased to 50MW	Solar PV generation increased to at least 140MW (from 89MW currently). Onshore wind generation increased to at least 75MW (from 3MW currently).	*Although the overall carbon intensity of electricity and gas from the National Grid are not directly within the control of NWLDC, the installation of renewables within the district as a contribution to the overall is a relevant consideration for this report.*
Waste	**2025** for the recycling rate to be 70% **2025** for 20% reduction in food waste **2025** for no biodegradable waste to landfill **2025** for anaerobic digestion to contribute locally to power generation	Residual emissions from waste and wastewater treatment beyond the local measures to reduce waste as far as possible need to be considered at a National level.	*Landfill sites should be all closed.* *All collection vehicles should be electric.* *Increasing recycling rates would decrease waste costs in the district.*

[19] Note: the CCC Report also includes sections on f-gas emissions and Greenhouse Gas Removals, which are not relevant to this local Carbon Gap Analysis.

Sector	Interim Targets	2050 Target	Notes
Transport	**2020-2025** for trials on decarbonisation of HGVs in the district **2021** for all new homes to be required to have electric car charging points **2021** for all public carparks to have electric car charging points **2025** for all petrol stations and service stations to have electric car charging points **2030** for public highways to be fitted with electric car charging points **2030** for all waste lorries to be electric **2035** for no new sales of petrol, diesel or hybrid cars **2040** for railways to be electrified OR trains run on hydrogen	Increase in walking and cycling to lead to 10% reduction in car miles No petrol, diesel or hybrid cars or vans on the road All HGVs electrified or using hydrogen	*Government targets to ban sales of new petrol and diesel cars by 2040. The Committee on Climate Change is recommending an earlier date.*
Forestry, land and agriculture	**2030** for 80% of broadleaf woodlands to be actively managed. 40ha of new woodland planted annually in the district during the period **2020-2050**	10% of farmland with newly planted trees	*The National Forest represents a significant asset and, if developed, could both reduce carbon emissions and improve tourism and the local economy.*
Industry	**2025** for the creation of a low carbon business park in the district. This is not critical to achieving decarbonisation, but could provide a good opportunity for public and private sector collaboration to create a replicable model.	Net zero through energy efficiency, low carbon fuels and carbon capture solutions. Shift to a different economic base for employment locally.	*Seek to retain industry and not drive it elsewhere, but provide support industries to reduce their emissions.* *Construction methods will need to change in the wider context – encourage these industries to decarbonise their products.*
Aviation and shipping	-	-	No specific targets for NWL at this stage.
F-gases	-	-	No specific targets for NWL at this stage.
Greenhouse gas removal	-	-	No specific targets for NWL at this stage. NWL could seek to house a potential industrial cluster

Table 8.01 – Proposed targets to reach net zero emissions in North West Leicestershire, organised by sector

9.0 TRANSLATING THE TARGETS INTO ACTIONS

9.1 Action types and levels of control

Throughout our sector-by-sector analysis in chapters 11 to 16, actions and initiatives towards a zero carbon North West Leicestershire are considered in terms of the potential influence and control that North West Leicestershire District Council has:

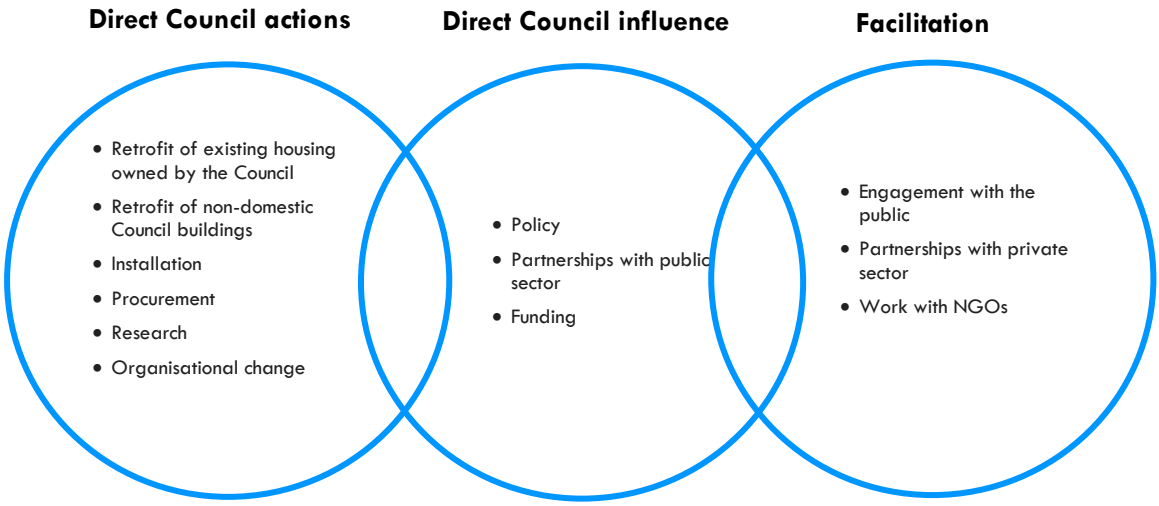


Figure 9.01 – The different levels of control of the District Council towards Net Zero Carbon

The relative sizes of each level of control in terms of total district emissions are summarised in Figure 9.02, based on the following considerations:

Direct Council actions - North West Leicestershire's direct control extends to those areas over which it has direct responsibility, through ownership of assets or operations. We have estimated GHG) emissions from this category to be **18 $ktCO_{2e}$**. (2017), approximately 1.5% of the total emissions from the district.

Direct Council influence – The council's actions can be extended beyond that for which it has direct responsibility for through the creation of specific planning policies, partnerships with other bodies and organisations, and through engagement initiatives. We estimate that the council has direct influence over a further **413 $ktCO_{2e}$** of future emissions through new policy and partnerships. This equates to approximately 32% of the total emissions from the district.

Facilitation – North West Leicestershire is able to facilitate carbon reductions from the private sector through engagement initiatives, business and industry and NGOs. We have estimated GHG emissions from this category to be **846 $ktCO_{2e}$** approximately 66% of the total emissions from the district.

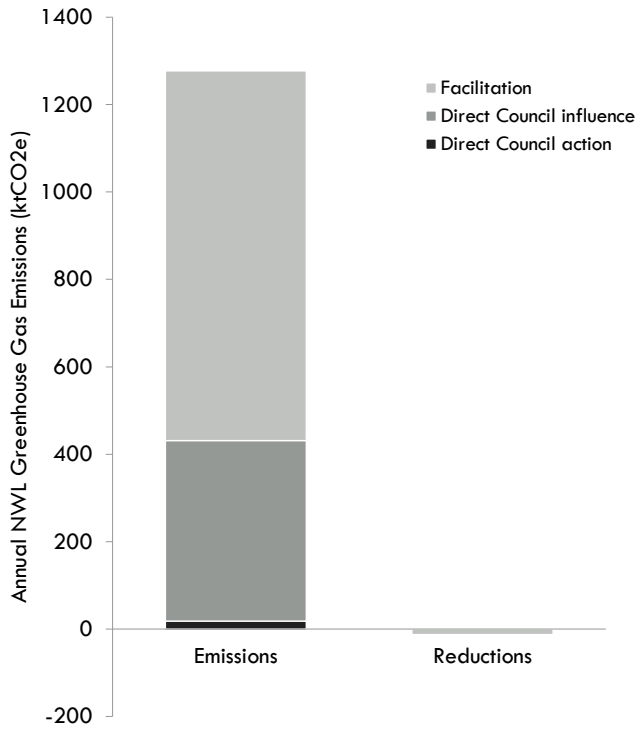


Figure 9.02 – Annual greenhouse gas emissions from North West Leicestershire in 2016 by level of Council control

9.2 Actions required from North West Leicestershire District Council

The table on the following page identifies general areas of action that must be pursued by the Council to reach net zero GHG emissions, categorised by the level of Council control. A detailed action plan that outlines specific actions that must be taken is presented in the next section of this report.

Sector	Direct Council actions	Direct Council influence	Facilitation
Buildings and towns			
Domestic buildings	• Retrofit of existing housing owned by the Council • Standards of future housing built or acquired by the Council, or on Council land.	• Planning requirements for all future housing	• Campaign on carbon reductions for existing housing not owned by the Council
Non-domestic buildings	• Retrofit of existing buildings owned and operated by the Council (e.g. Council's offices) • Standards of new buildings built or acquired by the Council (e.g. new Leisure Centre)	• Planning requirements for all new buildings • Retrofit of existing buildings owned by the Council but operated by others (e.g. Hood Park leisure centre) • Retrofit public buildings (e.g. schools and libraries)	• Engagement with owners and occupiers of existing offices (e.g. business parks) • Engagement with existing warehouse buildings (e.g. M&S, DHL)
Power			
Electricity generation	• Installation of PVs on Council's assets • Installation of wind turbines on Council's land	• Relaxing of planning restrictions for renewables • PV installations on other public buildings	• Private renewable energy installations

	• Green tariff		
Hydrogen		• New hydrogen infrastructure	
Waste			
Domestic waste	• Food waste collection and recycling from households	• Reduction and recycling of domestic waste from the Council's housing stock • Planning requirements for domestic waste storage and collection	• Resident behaviour and habits
Non-domestic waste	• Reduction and recycling of non-domestic waste from the Council's buildings • Food waste collection and recycling from the Council's buildings	• Planning requirements for non-domestic storage and collection • Legislation for business waste requirements	• Business behaviour and habits
Construction waste	• Reduction and recycling of construction waste from new housing and buildings built by the Council (e.g. new Leisure Centre)	• Planning requirements for construction waste (recycling, diversion from landfill)	
Transport			
Business Vehicles	• Replacement of other Council vehicles (e.g. cars) • Replacement of Council's waste lorry vehicles	• Replacement of cars owned by staff • Replacement of emergency vehicles • Replacement of buses	• HGVs • Vans
Private vehicles			• Replacement of cars
Infrastructure	• Electric charging points at Council's buildings and car parks	• Planning for electric charging infrastructure • Electric charging points on highways (LCC owned) • Rail infrastructure	• Electric charging points at existing petrol stations and private car parks.
Forestry, land use and agriculture			
Forestry	• Tree planting schemes on District Council owned land • Devise and implement plans for every green space owned by the council to enrich carbon capture and storage.	• Highlight, adjust and actively pursue policies on minimum areas and quality of green space required in new housing developments, protection of green infrastructure on private land and increase in afforestation	• Engage with NGOs, local and national charities on conservation and biodiversity and support grant and other funding applications by these organisations for improvements to Green Infrastructure in the district. • Encourage local landowners to increase tree planting
Wetlands & Heathlands		• Implement Planning policies to reinforce protection of the existing areas Engagement with NGOs to enrich the existing and reinstate or enhance where possible	

Agriculture	• Reduce the meat content and increase vegetarian choices of food sold in Council premises. • Organise a local food fair event to promote locally produced food, especially fruit and vegetables.	• Seek changes to food consumed in schools and hospitals to increase consumption of fruit and vegetables and reduce meat.	• Run public awareness events to encourage changes to food consumed by residents and workers in the district.
Industry			
Industrial processes		• Planning pollution limits	• All industrial processes
Construction products	• Specification and procurement of construction products on new Council buildings (e.g. new Leisure Centre) and refurbishments (e.g. Council's office)	• Planning requirements regarding materials	• Construction products used in projects not subject to planning
Aviation and shipping			
Aviation	• Reduction of staff flights	• Staff's flights outside work • Planning around East Midlands Airport (e.g. expansion, hours of use).	• Private and business flights • East Midlands Airport
Shipping	• Procurement		
F-gases			
F-gases	• Specify low Global Warming Potential (GWP) refrigerants in systems used by the Council	• Planning restrictions to require use of low GWP F-gases	• Require use of low GWP refrigerants by residents and businesses

Table 9.01 – Emission reduction action areas in each category

9.3 Structuring actions required from North West Leicestershire District Council

We have structured the actions required to take NWL to zero carbon by 2050 by: i) source of emissions, ii) level of council control and iii) action type. This is reflected in the visual summary and the Carbon Reduction Actions Matrix.

1. **Emissions source**, broken into 3 tiers:
    a. Emissions sectors - aligned with the Committee on Climate Change GHG emissions sectors. e.g. Buildings, Power, Transport etc.
    b. Sector categories – e.g. Non-domestic building, domestic buildings, etc
    c. sub-categories – e.g. Existing buildings, new buildings etc
2. **Level of Council control over required actions**: Direct, Influence and Facilitation.
3. **Categories for action types** – e.g. policy, retrofit, procurement.

9.3.1 The Carbon Reduction Actions Matrix

All Council actions that have come out of our 'Sector-by-Sector Analysis' in chapters 11 to 16 have been added to an Excel spreadsheet that accompanies this report. The intention is that the Matrix can be integrated into North West Leicestershire District Council's working practices as a fluid document that can be filtered and manipulated to suit.

The matrix has intentionally been kept simple, and aligns with the structure outlined above, and used throughout this report. In this way, different departments and services areas can easily filter the actions to see what is applicable to them. It also allows for additional columns to be added should this suit the council.

Matrix of CO2 Reduction Initiatives for NWLDC					
Project Number	20190234				
Project Name	NWL Carbon Gap Analysis				
Tab	Carbon reduction actions				
Revision	A				
Sector	Category	Sub-category	Action category	Level of control	Action
1. Buildings and towns	Non-domestic buildings	Existing - council	Organisational change	Direct	Assess the utilisation of council owned buildings and analyse whether there is the potential for consolidation.
1. Buildings and towns	Non-domestic buildings	Existing - council	Procurement	Direct	Procure 'green electricty' for council buildings and operations.
1. Buildings and towns	Non-domestic buildings	Existing - council	Procurement	Direct	Initiate a prorgramme of replacement of obsolete white goods with energy efficient alternatives.
1. Buildings and towns	Non-domestic buildings	Existing - council	Procurement	Direct	Switch to low carbon energy supply for council buildings.

Figure 9.03 - Screenshot of Excel based Actions Matrix which accompanies this report

9.3.2 A visual summary

The three tiers are represented visually in Figure 7.04, where the colours identify the CCC GHG emissions sectors and the central text explains the sector categories and sub-categories. The dots on the outer rings indicate the level of control that the Council has over these emissions, with each dot representing a category of actions that must be taken by the Council.

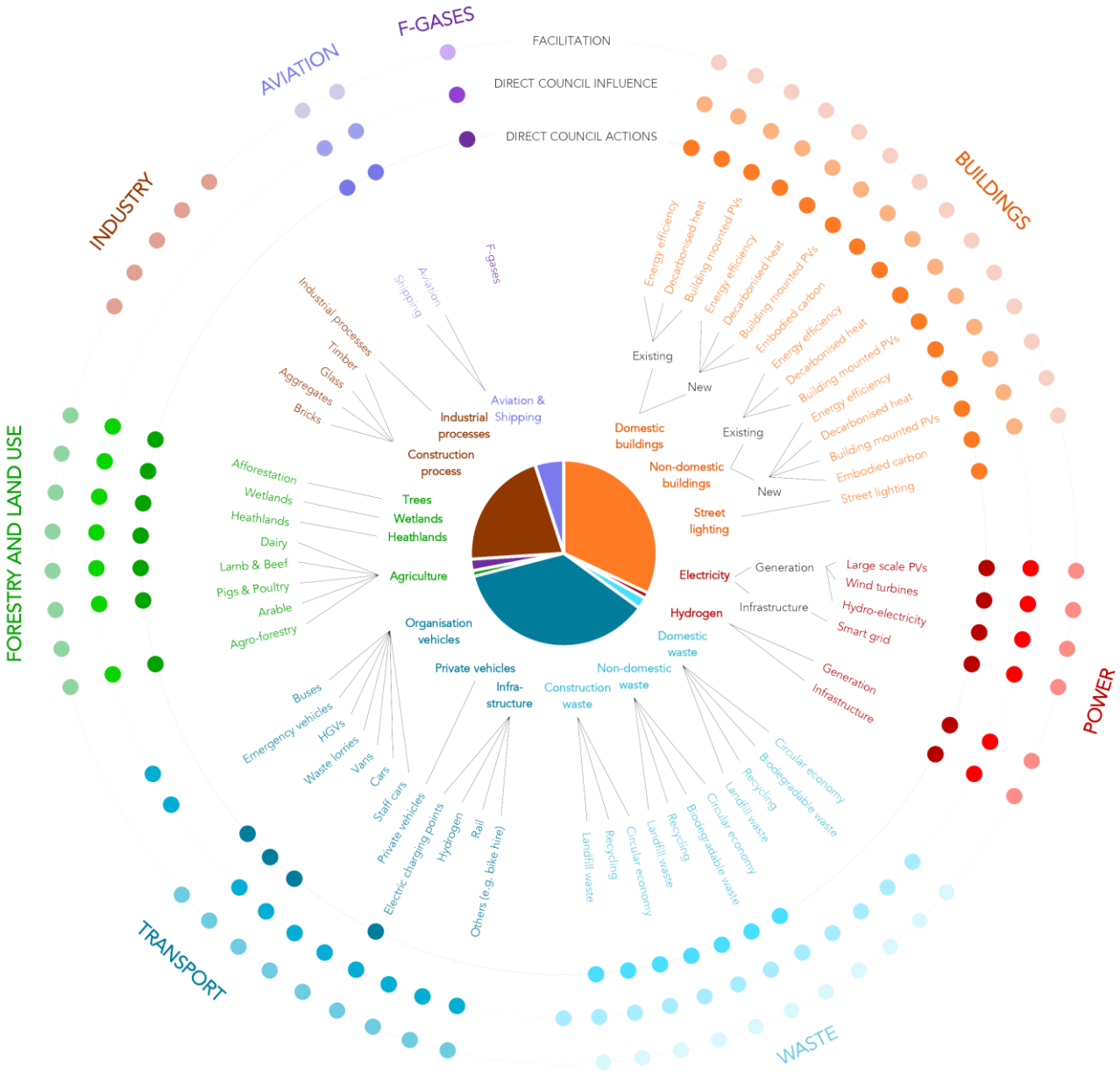


Figure 9.04 – Range of actions required in all key sectors to achieve Net Zero Carbon.

10.0 ACTION PLANS

Two separate action plans have been created for the Council and are included with this report. The first outlines a set of actions the Council must take if it is to achieve net zero GHG emissions by 2030 within its own operations. The second provides a broader set of actions that must be taken if the Council wishes to put the district of North West Leicestershire onto a pathway toward net zero GHG emissions by 2050.

10.1 A net zero Council by 2030: Direct Council actions

A number of direct actions have been identified throughout this report and listed in the Actions Matrix. We consider 'Direct council actions' to be any actions that North West Leicestershire District Council can take to directly impact greenhouse gas emissions from their own assets and operations. These generally fall into the following categories: retrofit; installation; procurement; research and organisational change.

While the CO_2 emissions that NWL DC have 'direct' control over only amount to 1.5% of the district's CO_{2e} emissions as a whole, they are nonetheless essential emissions to tackle. Tackling these emissions early sets an excellent example for the remainder of the district and beyond. The timing of "direct actions" targets has therefore intentionally been set earlier than targets for the remainder of the district.

10.2 A net zero district by 2050: Direct Council influence and Council facilitation

10.2.1 Planning policy and the Local Plan opportunity

The single most important action category to achieve a net zero GHG emission district is Policy. The potential for policy to cause significant change within the district cannot be understated[20]. New policies should be bold and reflect the urgency of the changes that we need to see to avert catastrophic climate change. North West Leicestershire has declared a climate emergency in June 2019.

North West Leicestershire District Council are currently undertaking a review of the Local Plan adopted in 2017. It is expected that the new Local Plan will be finalised in 2021. This is a vital opportunity to introduce policies for new developments in the district to support the transition to Zero Carbon.

Viability assessments are undertaken on any new planning policies. It is important that the Council's consultants who undertake these viability assessments use the latest and most up to date costs and account for projected cost reductions as economies of scale take effect[21]. In the event that a viability assessment challenges the case for a zero-carbon policy, the viability assessment should be independently reviewed, with a view to identifying solutions to achieve both viability and zero carbon compliant performance.

Where it is identified that there is a lack of policy at the national level to support the creation of new district level policies that support climate change, it is important to place pressure on central government to improve the national policy to facilitate a transition to zero net carbon.

10.2.2 Public sector partnerships

The 'Partnerships' action categories relate to any partnership or initiative that seeks to engage and influence these sectors. Actions within the category "Partnerships – Public Sector" involve engaging with other public sector organisations such as Leicestershire County Council, schools, the NHS and the National Forest to seek ways in which working together may enable more effective change. For example, working with Leicestershire County Council to highlight the need for electric car charging points on highways across the district.

10.2.3 Private sector partnerships

The private sector in this context of our action categories includes businesses, retail, industry, mining, farming etc. Together they account for the majority of the CO_2 emissions in North West Leicestershire and therefore represent a very important group to target.

[20] The Committee on Climate Change (CCC) have stated that it will only be possible to meet our zero carbon targets by introducing more clear, stable and well-designed policies to reduce emissions across the economy – current policies are insufficient to achieve the targets.

[21] The Committee on Climate Change have found additional costs of building ultra-low energy buildings with heat pumps to be 1.1-4.3%, while the Passivhaus Trust have reported additional costs of 4% or less at scale.

Actions within the category "Partnerships – Private Sector" could be allocated to a sustainability officer or integrated into the 'Business Focus' team's responsibility with support from a sustainability officer.

An example would be creating sector-based networks for sharing knowledge and best practice relating to energy efficiency and the transition to being zero carbon. It could also involve providing re-training schemes for heating engineers to install heat pumps instead of gas boilers, or creating award schemes that reward private companies that make progress against certain objectives towards becoming zero carbon.

10.2.4 Public engagement

Engagement with the public is an important part of the transition to a zero-carbon society. The public interact with all sectors – housing, transport, retail, business and more – and have the ability to influence change through their habits, spending and political voice.

The public are largely unaware of the impacts of their actions on GHG emissions and of the changes they will need to make. In the absence of this knowledge, fear and resistance to change can build. By explaining what changes are ahead and why they are required, people can prepare, feel positive, and see opportunity rather than threat. Part of North West Leicestershire District Council's strategy therefore must be to raise awareness, educate and inspire its residents to take action themselves.

We recommend a programme of engagement with the public that clearly communicates that the Council has a plan to respond to the climate emergency, and explains key elements of the plan and how the public can take action. By enabling the public to feel part of the mission North West Leicestershire District Council can achieve more.

10.2.5 Organisational readiness and commitment

Effectively addressing climate change and achieving a goal such as zero carbon is no small task. By laying the right foundations immediately, NWLDC have a better chance of successfully implementing the actions that have come out of our analysis in chapters 12 to 17 and achieving the targets.

North West Leicestershire District Council will need the engagement of all employees – from the top of the organization down to the bottom in order to be able to successfully implement the changes that will be required.

A holistic approach will need to be brought to every action and decision the council takes – from the big decisions right down to small ones.

We have therefore made a number of recommendations involving organisational readiness and commitment, that include internal culture, processes, policies and frameworks, that will create a strong culture that underpins and supports the council in making a transition to zero carbon.

We believe the council should act as local and regional leaders, and therefore recommend that goals for both the Council and district as a whole are reached in shorter timeframes where possible.

Sector-by-sector analysis

Current and future trends

Guidance on how to reduce carbon emissions for each sector

- Electricity decarbonisation
- Building energy efficiency and heat decarbonisation
- Transport
- Waste
- Forestry and land use
- Others: industry, aviation and F-gases

11.0 ELECTRICITY DECARBONISATION

Electricity has become a greener fuel and will continue to decarbonise in the future. The evolution of the carbon intensity of grid electricity over the period 2019-2050 will influence several areas of North West Leicestershire's zero carbon strategy.

It will affect positively the emissions associated with use of electric vehicles, electricity use for lighting and equipment in buildings, the carbon content of heat produced from heat pumps

and electrical heating systems. It will affect negatively the emissions of technologies such as gas-fired combined heat and power that rely on offsetting emissions for electricity they produce.

It is therefore very important that North West Leicestershire 'plays its part' in the decarbonization of the grid so that the National Grid can decarbonise through the installation of PVs, wind turbines and hydro-electricity.

North West Leicestershire District Council should also work with the Distribution Network Operators (DNO) so that the local grid can become a 'smart grid', able to use more renewable energy, charge more electric cars, heat more buildings and use electricity more dynamically on the system.

Finally, hydrogen may play a part in tomorrow's energy future and NWLDC should liaise with partners to consider its potential.

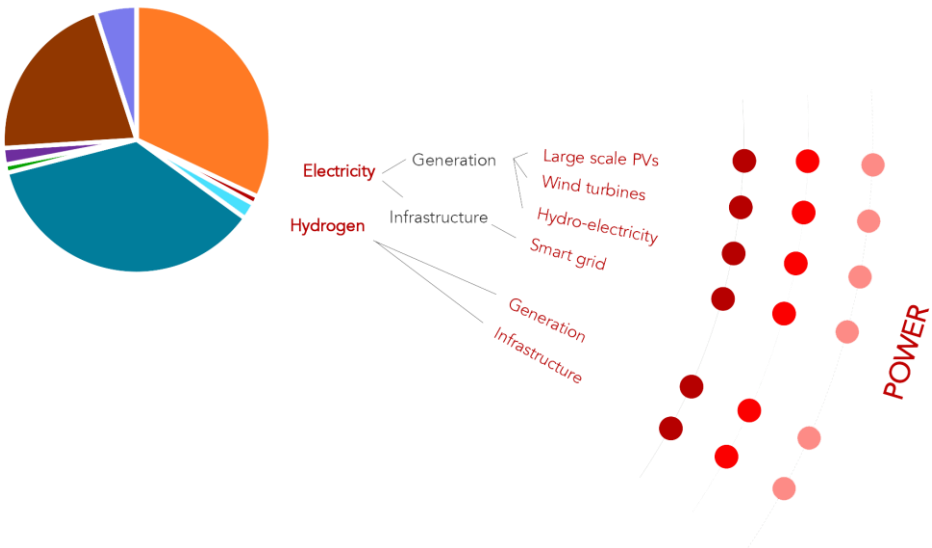


Figure 11.01 - NWLDC Electricity decarbonisation efforts in the context of the overall carbon reduction strategy

11.1 National context: the electricity grid decarbonisation

Each year, the National Grid produces a set of future energy scenarios[22] for the UK. The most recent version covers the period from 2018 to 2050 and considers both energy supply and demand. Four different scenarios are used to test predictions using a range of technical, financial and societal variables. The most important metric considered in these scenarios with respect to addressing climate change is the carbon intensity of grid electricity. This is a measure of greenhouse gas emissions, measured in grams of carbon dioxide equivalent, per kilowatt hour of electricity sold.

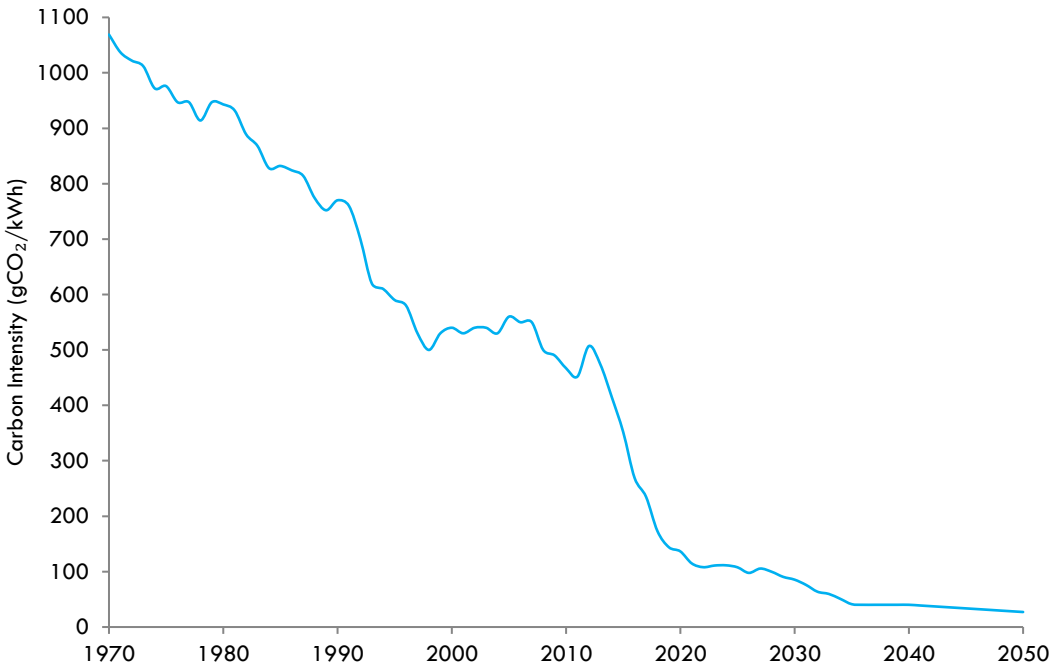


Figure 11.02 – Historic and projected carbon intensity of electricity from the UK's power grid[23]

Figure 11.02 shows the past and projected carbon intensity of grid electricity, based on a range of data sources. Future projections are taken from BEIS[24] and HM Treasury[25], which exhibit good agreement with the National Grid's latest projections.

The four National Grid scenarios were assessed to determine the most applicable one to use as the basis for projecting the UK's electricity generation mix in this report. The table on the following page shows the conclusions of this assessment, while Figure 11.03 shows how the UK's electricity generation mix is likely to change based on the selected 'Community Renewables' scenario, which was deemed the most viable.

[22] National Grid (2018) *Future Energy Scenarios*
[23] For more details about the data sources used to prepare this figure, which includes over 40 years of historical data and additional scenarios from the National Grid, please refer to Appendix A.
[24] BEIS (2019), Updated Energy and Emissions Projections
[25] HM Treasury (2019), HM Treasury Green Book

'Steady Progression'	Discounted – not compliant with avoiding 2˚C warming
'Consumer Evolution'	Discounted – not compliant with avoiding 2˚C warming
'Two Degrees'	Discounted – relies on nuclear supply increasing from 19% in 2018 to 29% in 2050. Not considered realistic as three of six proposed new nuclear projects have been cancelled, nuclear has consistently failed to attract private investment and electricity prices are higher than those for onshore wind, offshore wind and solar photovoltaics.
'Community Renewables'	Considered – used as basis for forecasting future UK electricity generation mix as offers most feasible 2˚C compliant pathway.

Table 11.01 – National Grid Generation Mix Scenarios (© National Grid, 2018)

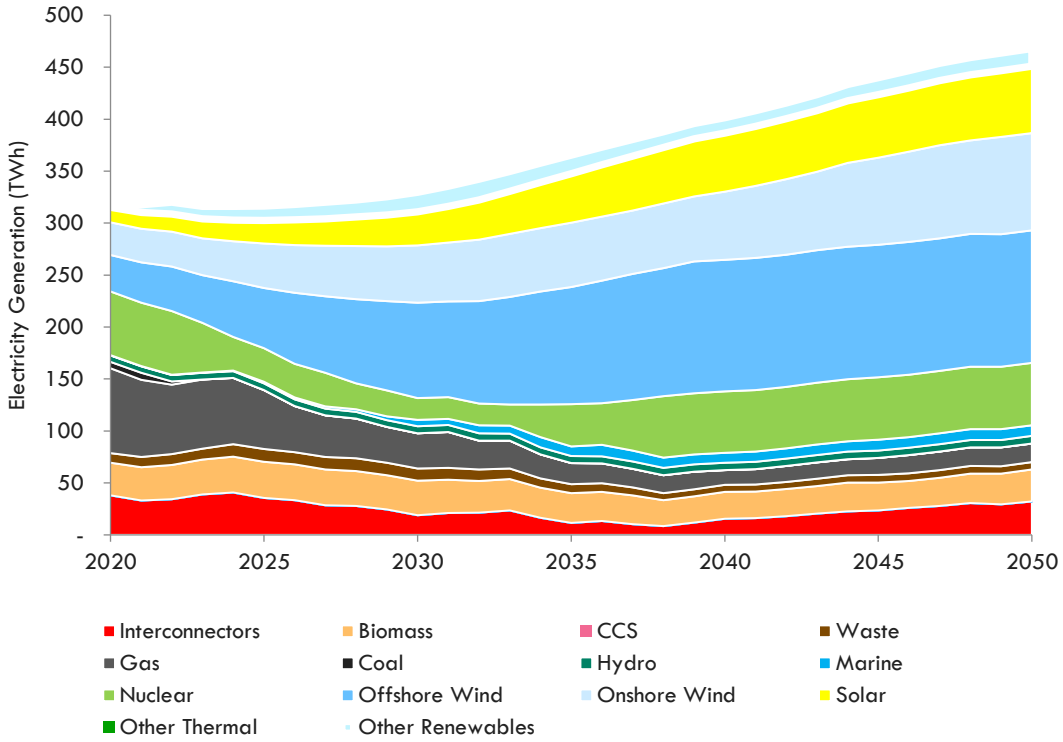


Figure 11.03 – National Grid 'Community Renewables' Scenario (© National Grid, 2018)

Figure 11.03 clearly shows how wind, solar and nuclear power are being deployed to achieve a low carbon electricity mix. Key strategies to achieve this level of decarbonization at a national level are:

- increasing **solar capacity** from 12GW to 66GW
- increasing **onshore wind capacity** from 12GW to 51GW
- increasing **offshore wind capacity** from 6GW to 33GW
- Maintaining around 9GW of **nuclear capacity**.

While some gas generation is still required in 2050, it provides only 4% of electricity 2050, compared to 36% in 2018.

11.2 Electricity in North West Leicestershire

11.2.1 Current levels of electricity use and generation

Estimated electricity consumption in 2017 totalled 569 GWh, of which 174 GWh was domestic and 395 GWh non-domestic[26].

This level of consumption is compared in Figure 11.04 against the district's electricity generation. It should be noted that majority of electricity used in the district is generated outside it though.

The level of district's electricity generation was determined within North West Leicestershire using government deployment data[27,28] on solar, onshore wind, waste to energy and anaerobic digestion. The quantities of nuclear, hydro, pumped storage, imports, coal and biomass in Figure 11.04 are based on national averages, with the remainder assumed to be met through gas generation.

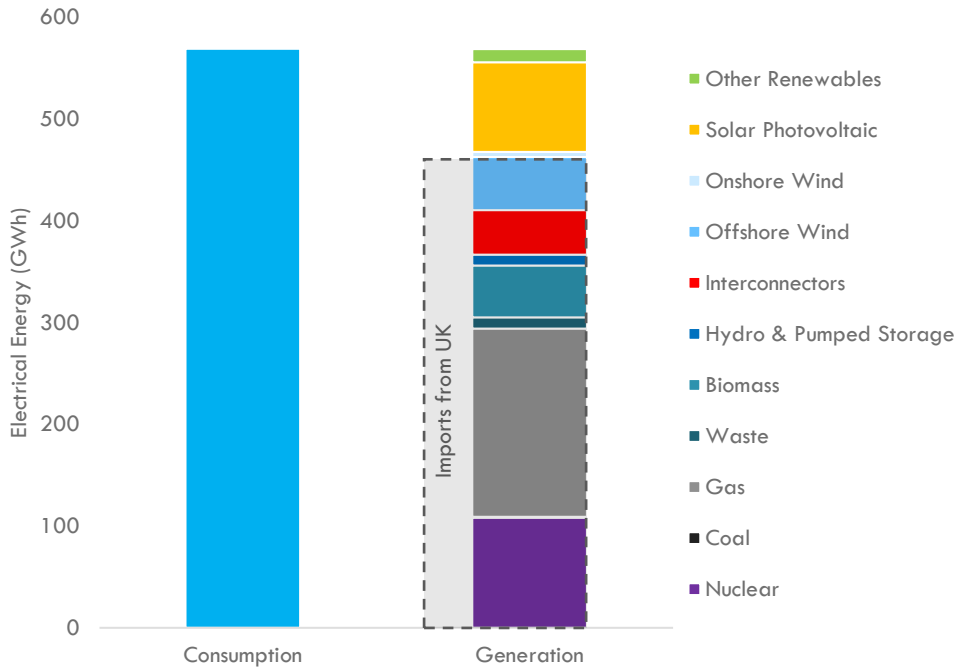


Figure 11.04 – NWL Electricity consumption and generation in 2018

[26] BEIS (2019) *Sub-national electricity sales and numbers of customers 2005-2017*
[27] BEIS (2019) *Monthly Central Feed in Tariffs Register Confirmation Statistics May 2019*
[28] BEIS (2019) *Renewable Energy Planning Database*

Solar Photovoltaics

NWL has already made excellent progress in deploying solar photovoltaic technology, with 89MW of systems either installed, or having received planning approval, as shown in the figure below. This represents over 15% of NWL's electricity consumption[29], well above the national average of 4%.

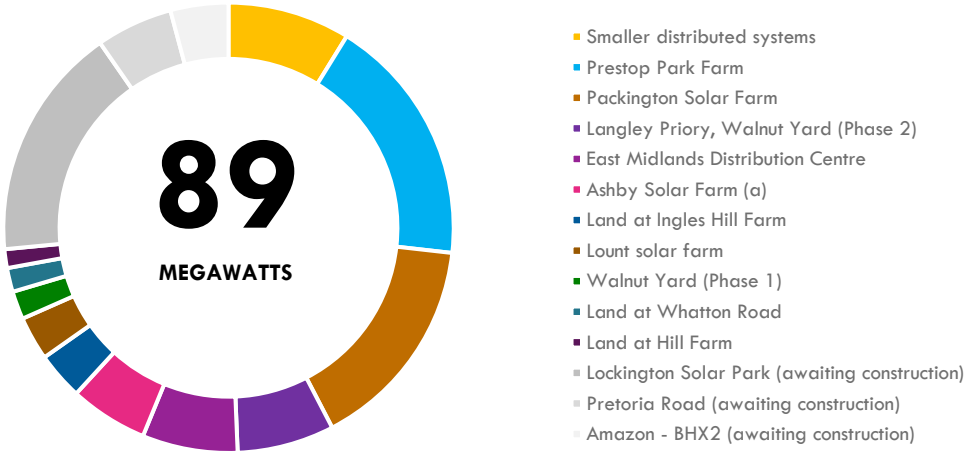


Figure 11.05 – Operational and permitted solar projects in NWL (BEIS, 2019)[30]

Onshore Wind

Only 0.92% of North West Leicestershire's electricity is generated by onshore wind turbines. This is significantly below the national average of 9.36%. The largest turbines are a pair of 0.25MW units installed at East Midlands Airport[31]. A further 2.7MW of turbines are registered on the government's database, it is assumed these are all small-scale turbines.

Landfill Gas

A 1.1 MW landfill gas powered generator is operated by SITA at Ashby De La Zouch, which is estimated to provide around 1.2% of the district's electricity. This is a short-term resource as peak gas production usually occurs 5-7 years after landfill occurs, with almost all gas production complete within 20-25 years.

Anaerobic digestion

Just under 1 MW of anaerobic digestion is recorded on the government's databases, this is estimated to provide around 1.1% of the district's electricity.

[29] Assuming annual energy generation of 988kWh/kW, equivalent to an 11.3% capacity factor.
[30] BEIS (2019) *Solar Photovoltaics Deployment in the UK April 2019*
[31] These are relatively small compared to typical onshore wind turbine sizes of 2-3MW

11.2.2 Current NWDLC policy - North West Leicestershire Local Plan

Relevant Objectives from the local plan are Objective 8 to "prepare for, limit and adapt to climate change", and Objective 14 to "seek to deliver the infrastructure needs of the area, including Green sustainable development". Several policies either directly or indirectly progress the use of renewable energy. These are summarised below.

Policy S3 – Countryside
"Land outside the Limits to Development is identified as countryside where those uses listed (a) to (s) below will be supported, subject to those considerations set out in criteria (i) to (vi) below.
(o) Renewable energy;"

This policy specifically supports the use of renewable energy, subject to a range of conditions of a generally discretionary nature.

Policy D1 – Design of New Development
"The Council will support proposed developments that are well designed and as a minimum offer a good standard of design:
(2) New non-residential developments must positively address our Place Making principles:
c) A greener footprint;
(5) New development should have regard to sustainable design and construction methods."

The local plan also specifically supports the development of small-scale renewables:

"6.25 The following measures are examples of what could be incorporated in to new developments to mitigate and adapt to the effects of climate change:

Incorporating small scale renewables into the design of new developments where there would be no significant adverse impacts on landscape, ecology, heritage assets and amenity;"

Policy Ec5 – East Midlands Airport: Safeguarding
"(2) The outer boundary of the Safeguarded Area is shown on the Policies Map and within this area consultation with East Midlands Airport is required on the following proposals:
(f) Any proposal for a wind turbine development within a 30km circle centred on East Midlands Airport."

This policy is based on Civil Aviation Authority guidance[32]. It does not prohibit wind turbine development within 30km, as evidenced by the pair of 25kW wind turbines installed at East Midlands Airport.

Policy Cc1 – Renewable Energy
"(1) Planning applications for renewable energy including any new grid connection lines and any ancillary infrastructure and buildings associated with the development will be supported where:
(a) There is no unacceptable impact on residential amenity in terms of noise, shadow flicker, vibration and visual dominance; and
(b) There is no adverse impact on the landscape character taking account of the special qualities set out within the individual National Character Areas; and
(c) All impacts on biodiversity have been adequately mitigated or enhanced; and
(d) Heritage assets and their settings are conserved or enhanced; and
(e) Proposals take account of the cumulative effect that would result from the proposal in conjunction with permitted and existing renewable energy schemes; and
(f) Proposals are accompanied by details to demonstrate how the site will be decommissioned to ensure the restoration of the site following cessation; and
(g) Proposals for large scale renewable energy should demonstrate that the economic, social and environmental benefits are for those communities closest to the proposed facility.

We will consider the preparation of a Supplementary Planning Document to provide further guidance on this issue.
(2) In addition to the above considerations, proposals for one or more wind turbines will be supported where:
(a) The site lies within the 'Area Identified as potentially suitable for large or small scale turbines' as defined on the policies map; and
(b) It can be demonstrated there is support from the local community or is set out within an area defined as being suitable for wind energy development within an adopted Neighbourhood Plan; and
(c) All impacts on air traffic safety as referred to in local plan policy Ec6 and radar and communications have been assessed and consulted upon."

[32] CAA (2016) *CAP764: CAA Policy and Guidelines on Wind Turbines*

The council has also been proactive in producing wind energy resource maps for small and medium to large scale onshore wind turbines.

11.2.3 Challenges

The main challenges to deploying sufficient solar and onshore wind technology are a range of recent policy changes by central government, which have effectively removed the route to market for these technologies.

The main barriers to solar technology are: the elimination of both the feed in tariff and export tariff, the expansion of business rates to include some solar panel installations in valuations, and proposed increases to the VAT rate on solar panels and battery storage systems from 5% to 20%. These will in part be resolved by the Smart Export Guarantee[33] due in January 2020 and the Solar Trade Association, who have developed a legal workaround that may enable some organisations to bypass paying additional business rates on rooftop solar systems.

The main barriers to onshore wind energy are their exclusion from the Contracts for Difference (CfD) scheme[34] and change to national planning system requirements that makes it relatively straightforward for a small number of objections to stop onshore wind development. These changes have reduced deployment by 80% in 2018 relative to 2017[35].

These challenges are expected to be resolved in the short to medium term as wind and solar are key elements of the UK's long-term renewable energy strategy. Industry efforts to work with central government to re-establish the route to market are ongoing, therefore it is recommended that NWLDC prepare for a renewed effort to deploy these technologies rapidly at scale.

11.3 Electricity decarbonisation

By 2050, North West Leicestershire will need to make a fair and proportional contribution toward the UK's need for renewable low carbon electricity. This may be calculated by assessing the district's forecast demand for electricity in 2050[36], and then subtracting electricity generation that by its nature must be provided from outside North West Leicestershire.

This includes electricity from offshore wind turbines, nuclear power plants, European interconnectors and other sources. The remaining electricity demand must then be met from local renewable low carbon electricity sources. In North West Leicestershire, as in most of the UK, these are principally solar PV and wind technologies. A zero-carbon compliant electricity mix for NWL in 2050 based on this methodology is shown in Figure 11.06.

33 This will require energy companies with over 150,000 customers to offer an export tariff payment to customers who export solar electricity to the grid.

34 The CfD scheme uses competitive price auctions to procure new renewable energy capacity at lowest cost.

35 Renewable UK (2019) *New onshore wind installations plummet in 2018*

36 It is assumed consumption of electricity in 2050 is 145% of consumption in 2017 based on the projected national increase due to the electrification of heating and transportation in the National Grid's "Community Renewables" scenario.

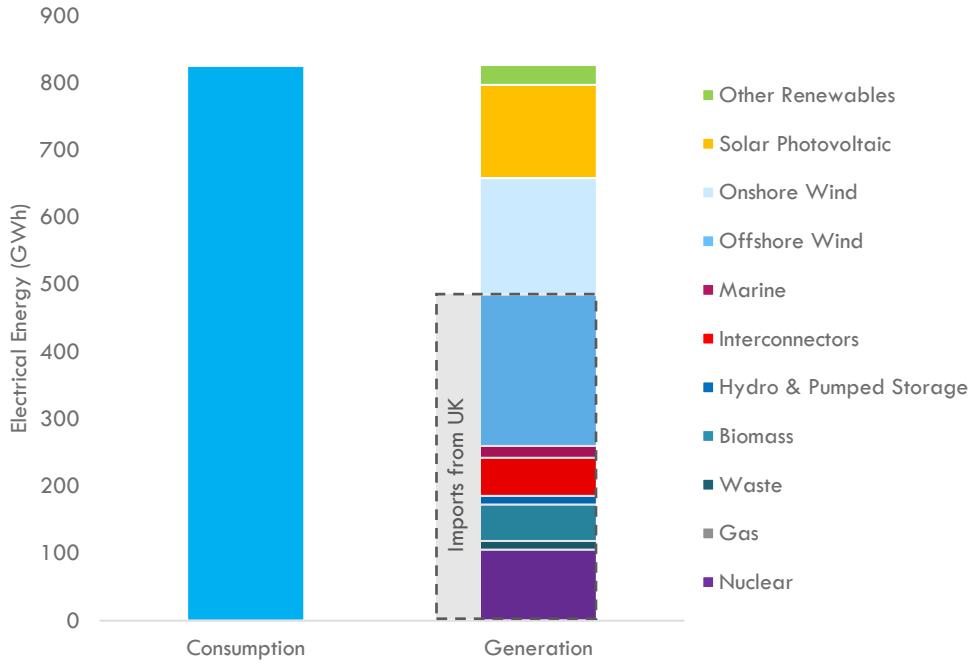


Figure 11.06 – NWL Electricity consumption and generation in 2050

11.3.1 Electricity Generation Technologies

At least two studies have previously assessed the potential for renewable energy in North West Leicestershire. These include a 2008 study by IT Power[37] and a 2011 study commissioned by East Midlands Councils[38]. These have been reviewed to assess the viability of meeting the necessary levels of renewable energy in North West Leicestershire. It is clear that, as is the case globally, solar and onshore wind technologies will deliver the majority of low carbon electricity in the future. Both technologies offer some of the lowest prices of electricity in the UK and enjoy majority public support.

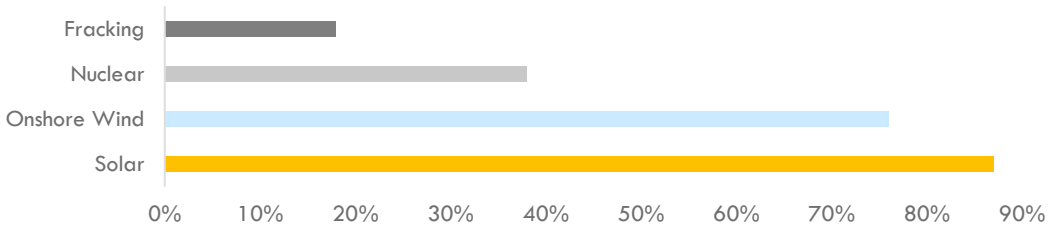


Figure 11.07 – Public support for fracking, nuclear, onshore wind and solar technologies [39]

Solar Photovoltaics

By 2050, North West Leicestershire's solar photovoltaic capacity needs to expand from 89MW to at least 140MW. This represents a modest increase and could be achieved through a combination of around two dozen solar farms and large commercial rooftop systems. There is good potential for both, as indicated in Figure 11.08

[37] IT Power (2008) *Renewable Energy Opportunities for Blaby, Harborough, Hinckley and Bosworth, Melton, North West Leicestershire, Oadby and Wigston and Rutland*
[38] Land Use Consultants, Centre for Sustainable Energy and SQW (2011) *Low Carbon Energy Opportunities and Heat Mapping for Local Planning Areas Across the East Midlands: Final Report*
[39] BEIS (2018) *Energy and climate change public attitude tracker: Wave 25*

using the industrial estate at Castle Donington as an example. The East Midlands Distribution Centre, on the centre left of the image, has a 6.1MW solar array using solar panels with modest efficiencies[40]. Installing solar on the other commercial buildings in this area could provide around one fifth of the additional solar power required by North West Leicestershire in 2050.

Figure 11.08 – Potential for commercial solar at Castle Donington

Expansion of rooftop systems should be encouraged as this avoids use of greenfield sites and provides building owners with decades of cheap clean electricity, retaining financial and social benefits within the local economy. Ground mounted solar farms typically generate slightly cheaper electricity; however, this must usually be sold directly back to the electricity grid, with reduced local benefits.

Onshore Wind

Onshore wind capacity in North West Leicestershire needs to expand from 3.24MW to at least 75MW by 2050. This could be achieved through the installation of 24 turbines of 3MW capacity[41]. Based on the Council's Onshore wind energy opportunity plan, the most viable sites are likely to be Normanton le Heath and the area to the South West of Chilcote.

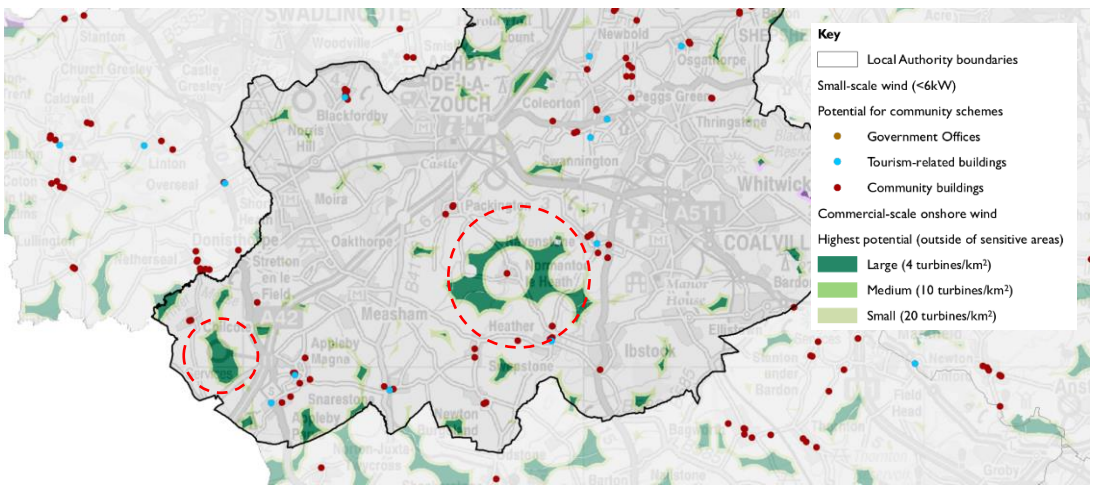


Figure 11.09 – Potential sites for onshore wind deployment (© NWLDC 2011)

[40] This system used 250W solar panels. Higher efficiency 340W panels would have created an 8.2MW system.
[41] The 2011 report commissioned by East Midlands Councils concluded there was potential for 64MW of onshore wind. It is assumed that 75MW would be possible through using larger turbines.

Onshore wind turbines can offer a range of local benefits including local energy discounts, community benefit funds, community investment opportunities and revenue generation for land owners[42]. Efforts to expand wind should focus on large turbines, which generally offer better performance and significant economies of scale. Several independent studies[43] have indicated that the performance of very small wind turbines, typically those under 10kW, is often poor. It is therefore suggested that their deployment is not actively encouraged.

A key concern with wind deployment is potential interference with operations at East Midlands Airport. The Civil Aviation Authority provides guidance on potential issues, however the existing 250kW turbines located at the airport and other case studies[44] suggest that mitigation measures are likely to be available.

Green Gas

Green gas can be used to generate electricity, fed into the gas network, or used to power vehicles. It is produced by anaerobic digestion of agricultural waste, food waste and sewage sludge or through gasification of drier biomass. Although landfill gas has been used in the past, the diversion of waste from landfill means there is unlikely to be a significant resource in the future. Anaerobic digestion or gasification is generally preferable to landfilling, which results in leakage of methane, a relatively strong greenhouse gas, to the atmosphere.

It is estimated that biogas production in NWL could be expanded to around 21GWh by 2050. This is based on the CCC's estimated potential for 14TWh of biogas nationwide, scaled by population to NWL. This approach is thought to be conservative as NWL may have higher than average agricultural biomass resource, while waste food and sewage resource are expected to scale proportionately with population.

In the case of electricity generation, annual energy production from biogas would likely be less than 2% of NWL's electricity demand in 2050. The CCC recommend that power generation from biogas is implemented with carbon capture and storage, however this is only likely to be possible at larger scales. As biogas-based electricity generation is often co-located with anaerobic digestion or gasification facilities, achieving carbon capture and storage may require shipping digestible waste to a larger facility where anaerobic digestion or gasification, electricity generation and carbon capture and storage facilities are co-located.

It is recommended that NWLDC develop a biogas strategy that either routes biogas to end-uses in hard to treat sectors where limited residual emissions are accepted and offset by carbon sinks within the district, or exports the biomass feedstock used for anaerobic digestion or gasification outside of the district where electricity generation co-located with carbon capture and storage is possible.

Hydroelectricity

Hydroelectricity refers to electricity that is generated by a turbine placed in the flow of a freshwater body such as a river. A government assessment of the potential for hydroelectricity in the region[45] and an earlier regional study[46] indicate there is potential for around 1.4% of the district's electricity to be generated from hydroelectricity[47]. A summary of the sites from these studies is provided below.

Location	Estimated annual electricity generation (GWh)
Trent Lock Weir	5.57
Ratcliffe Power Station Weir	3.00
Sawley Cut Weir	1.90

[42] DECC (2014) *Community Benefits from Onshore Wind Developments: Best Practice Guidance for England*
[43] Examples include the Energy Saving Trust's "Location, Location, Location" and Encraft's "Warwick Wind Trials"
[44] Carland Cross wind farm in Cornwall has 10 turbines of 2MW individual capacity and is located 10km away from the county's regional airport and spaceport at Newquay.
[45] DECC (2010) *England and Wales Hydropower Resource Assessment: Annex 3*
[46] IT Power (2008) *Renewable Energy Opportunities for Blaby, Harborough, Hinckley and Bosworth, Melton, North West Leicestershire, Oadby and Wigston and Rutland*
[47] Trent Lock Weir could generate 5.57GWh of electricity, while Kegworth Lock could generate 0.66GWh.

Kegworth Lock	0.66
Ratcliffe-on-Soar	0.53

Table 11.02 – Hydroelectric Potential in North West Leicestershire

While the total potential contribution from hydroelectricity to North West Leicestershire's electricity demands is very modest, it is recommended that feasibility is investigated at least for the larger sites. As some of the sites on boundaries with adjacent district councils, a joint approach may be required.

11.3.2 The Electricity Grid

In the United Kingdom the National Grid is the high voltage electric power transmission network operator. They ensure the electricity grid is balanced at all times. The local distribution of electricity is handled by 14 Distribution Network Operators (DNOs). The DNO for North West Leicestershire is Western Power Distribution.

Many of the changes required to reach net zero carbon emissions involve changes to the way we use the electricity grid. For example, increased generation of intermittent electricity from solar panels and wind turbines scattered across the electricity network will change the way power flows. Greater use of electric vehicles and heat pumps will create periods of very high demand for electricity.

The National Grid is very forward thinking and already plans for the UK electricity grid to be able to operate for extended periods solely on zero carbon sources of electricity by 2025. DNO's generally do not have the same level of resource as the National Grid and may be less proactive about upgrading their networks to facilitate the transition toward a zero-carbon society.

A range of strategies can be used to accommodate the changes required to the electricity network to reach net zero carbon emissions. These range from battery systems that can buffer power flows to smart control systems for electric vehicle chargers and heat pumps that can reduce peaks in electricity demand by controlling how much power they use and when they use it.

While the council does not have a direct role to play in the development of the electricity grid, it is recommended that the council establishes a strong working relationship with the DNO. It is important that the DNO is aware of the council's plans for electrification of heating and transport, and that the council is aware of large infrastructure upgrades that the DNO may need to make to facilitate this transition. There may also be some opportunity for the council to implement policies and actions that support the DNO's work in facilitating more widespread electrification of heat and transport.

Demand-side response (DMS)

Demand response is when energy users are provided with a financial incentive to turn down or turn off non-essential processes at times of peak demand helping the grid to balance supply and demand without the need for additional generation (e.g. power stations) to be used. Energy users can also be asked to use excess energy from the grid, for example on a windy day. DMS requires further development in line with electric vehicles implementation. Using DMS to support the grid opens the door to additional revenue streams – will bring an advantage while implementing the electric vehicles and charging points for further transition.

12.0 BUILDINGS AND TOWNS

GHG emissions from buildings are by far the largest single component of the Council's own emissions. Around one third of North West Leicestershire's total GHG emissions are also attributable to heating buildings. Tackling this sector is therefore crucial to achieving net zero.

We cannot reduce the number of buildings – if anything we need more of them, especially housing but also workplaces to support economic growth. Most of the existing building stock will still be here in 2050 and must therefore be retrofitted at scale to become more energy efficient. New buildings must also be built to very high levels of efficiency.

Achieving net zero carbon also requires an end to the use of carbon-based fuels for heating. Heating must effectively be decarbonised by 2050 through the use of heat pumps and other ultra-low emission technologies to ensure that net zero emissions are achieved.

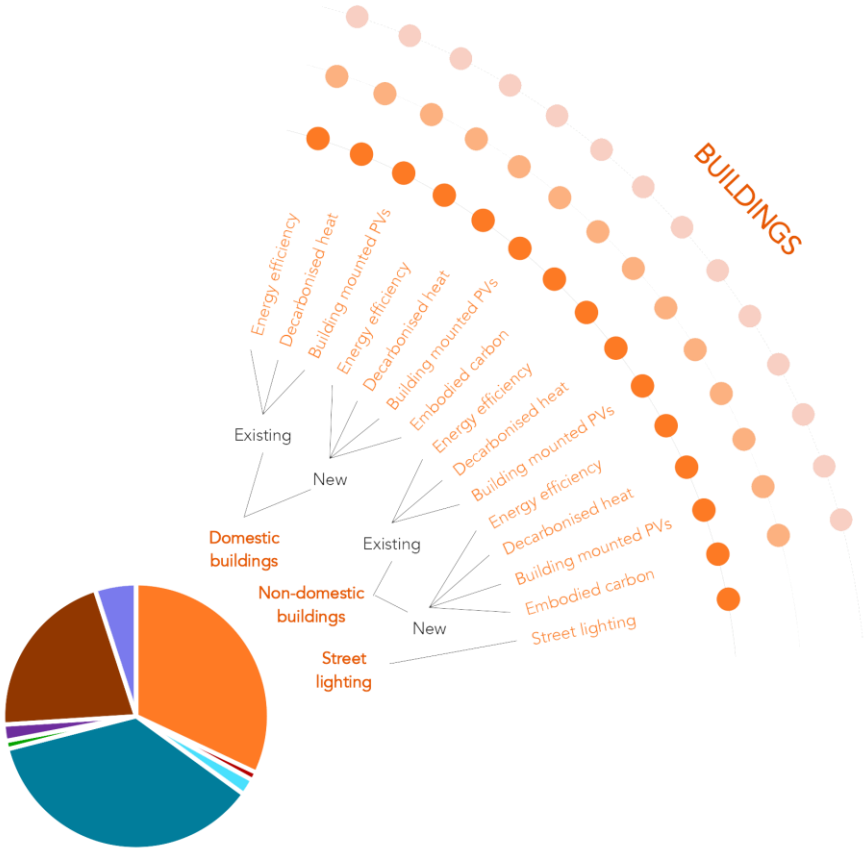


Figure 12.01 - Decarbonisation efforts for buildings in NWL in the context of the overall carbon reduction strategy

12.1 Buildings in North West Leicestershire

This section provides detail on the character of the building stock in North West Leicestershire in terms of carbon emissions. It looks into the changes that are planned and the sort of changes that would be needed to achieve significant greenhouse gas emission reductions in the district.

12.1.1 Categories of GHG emissions from buildings

GHG emissions from buildings may be sub divided into 4 categories:

Domestic or non-domestic. The most elemental division is between domestic properties (housing) and non-domestic. The characteristics and economics of energy demand are widely different between these two categories; domestic energy use is dominated by heating and hot water requirements. Non-domestic is much harder to simplify. It can be driven by lighting, such as in retail, or by computer use and air conditioning in offices, or by space heating or refrigeration in warehouses and distribution.

Gas or Electricity. The primary sources of GHG emissions from buildings are fossil fuels for heating and electricity generation. In domestic properties, heating and hot water are commonly from fossil fuel sources – gas boilers, oil boilers and coal fires – and electric heating. Electricity is also used for appliances, lighting, computers and digital devices, and in some cases cooking. Non-domestic properties are more likely to use electric heat pumps or gas boilers for heating, and often use large amounts of electricity for lighting and computers.

Figure 12.02 shows the proportions of GHG emissions from each of these categories in North West Leicestershire[48]. The emissions from non-domestic uses (both gas and electric) and domestic gas are all quite high, with domestic electricity use much lower. Gas – both domestic and non-domestic – is the source of more than half of the emissions and it may be supposed that most of both uses are for heating and hot water.

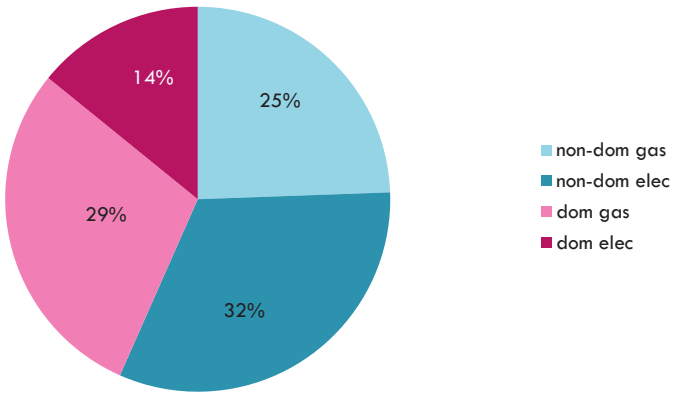


Figure 12.02 – Breakdown of GHG emissions from gas and electricity in North West Leicestershire

12.1.2 Building types in North West Leicestershire

In North West Leicestershire, the ratio of non-domestic to domestic buildings is high compared to other regions in the UK, as shown in Figure 12.03. This is a reflection of the relatively strong manufacturing economy in the District, and the consequent industrial areas surrounding many of the towns, such as Measham (Figure 12.04).

[48] The aggregated data is from BEIS Sub-national electricity and gas consumption statistics. The carbon factors used are 0.285 $kgCO_{2e}$/kWh for grid electricity and 0.185 $kgCO_{2e}$/kWh for gas.

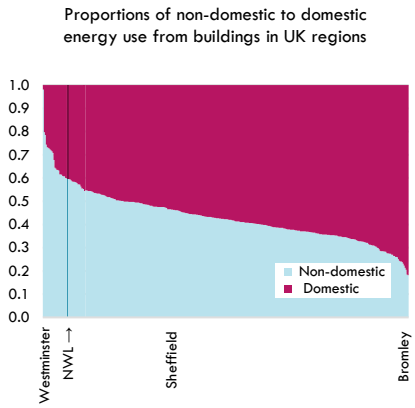


Figure 12.03 - Proportion of non-domestic to domestic energy consumption in UK buildings

Figure 12.04 - Aerial view of typical North West Leicestershire town © Google

12.1.3 GHG emissions from domestic buildings

NWLDC own 4,425 dwellings of a total of 43,190 dwellings in North West Leicestershire, which is just over 10%. Just over three quarters of the dwellings owned by the Council are houses, and most of these are 3 bed houses. We understand, anecdotally, that most of the 3 bed houses are semi-detached.

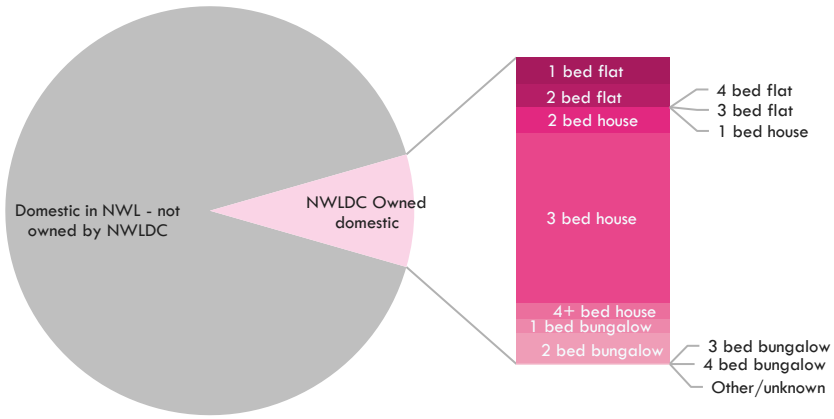


Figure12.05 - CO_2 emissions from NWLDC owned housing as a proportion of total in NW Leicestershire

Three quarters of the housing owned by NWLDC is located in eight towns, and the rest is located across 28 villages. The emissions from housing in each of these areas are shown in Figure 12.06 broken down by size of dwelling (indicated by number of bedrooms).

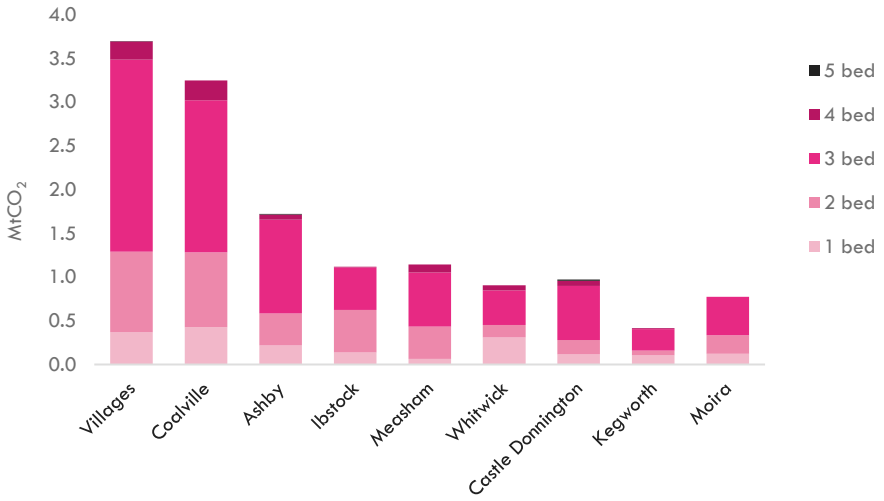


Figure12.06 – CO_2 emissions of Council owned housing by town and size of dwelling

Figure 12.07 on the next page shows the 20 developments likely to be responsible for the most emissions, and most of these are located in towns. The Greenhill housing estate in Coalville is the largest area of Council owned housing and accounts for approximately 15% of the Council stock emissions. The housing area with the next highest emissions is Thringstone, which accounts for 5%. Figure 12.08 shows examples of typical housing in Greenhill, Coalville.

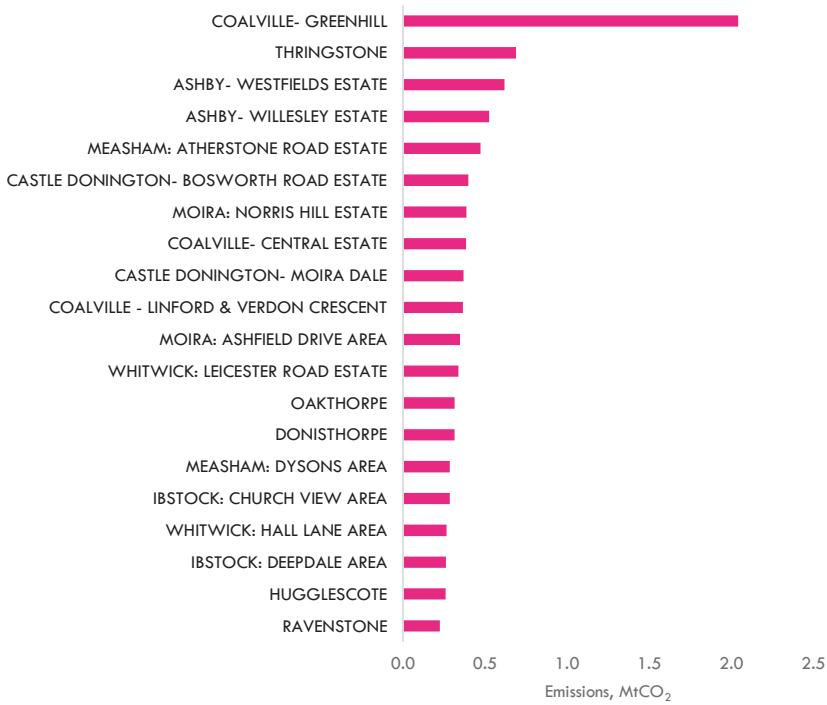


Figure 12.07 – CO_2 emissions of Council owned housing, 20 schemes with highest emissions

Figure 12.08 - Examples of typical housing in Greenhill, Coalville © Google streetview.

12.1.4 GHG emissions from non-domestic buildings

NWLDC own 35 non-domestic buildings, of which 10 are also operated by the Council. We estimate that the proportion of emissions from Council owned non-domestic buildings is approximately 1% of the total in the district, which is far less than for housing. However, there are buildings that are owned by Leicestershire Council over which NWLDC have influence, for example schools, and these make up a larger proportion. Non-domestic energy consumption is typically more difficult to categorise than the domestic stock, but we can make some assumptions about proportions of building use and building typologies to determine GHG emissions. Figure 12.09 shows the proportions of CO_2 emissions from Council owned non-domestic building compared to the total emissions from non-domestic buildings in the district.

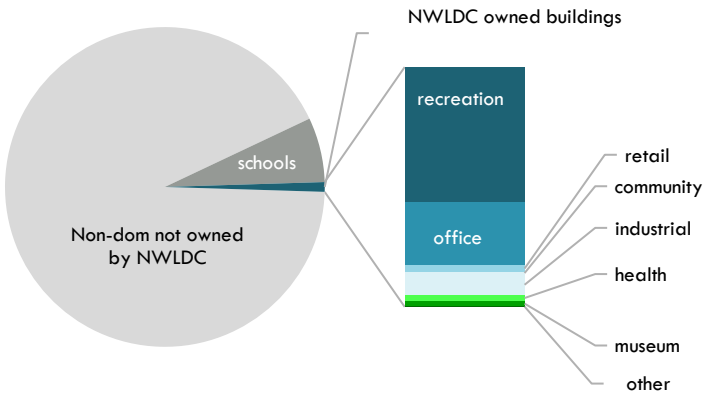


Figure 12.09 - Non-domestic CO_2 emissions from NWLDC owned buildings as a proportion of total in NW Leicestershire

Figure 12.10 shows an estimated breakdown of emissions of Council owned buildings, separating those which are operated by the Council from those which are operated by a third party. These emissions are dominated by the recreation sector, mainly by two leisure centres.

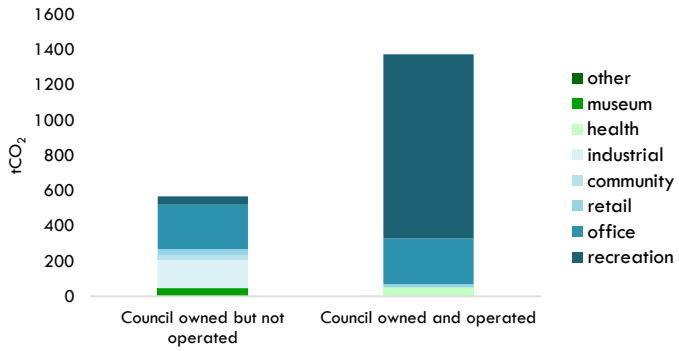


Figure 12.10 - Non-domestic CO_2 emissions from NWLDC owned and occupied buildings

The table on the following page shows emissions from buildings owned by the Council in rank order of current CO_2 emissions, and indicates with a * the four for which Display Energy Certificates (DECs) are available i.e. the buildings where the actual emissions are known and published.

	Name of building	tCO_2	Operated by NWLDC
1	Hood Park, Ashby Leisure Centre	501*	✓
2	Hermitage Recreation Ground and Leisure Centre	468*	✓
3	Council Offices, Whitwick Road	193*	✓
4	Units 1-16, The Courtyard	144	
5	Marquis Court Industrial Units, Rawdon	123	
6	Whitwick Business Centre	77	
8	Thringstone Bowls Pavilion (Loughborough Road)	47	✓
9	Ashby Health Centre Site	47*	✓
10	Market Street Industrial Units	34	
11	Moira Workshops	24	
12	Blackfordby & Worthington Post Office (Shops)	23	
13	Moira Furnace	19	
14	Market Hall (Belvoir Shopping Centre)	16	✓
15	Tanyard House	14	
16	Ashby Town Hall	10	
17	Forest Court	9	
18	Mease House	9	
19	Ashby Road, Moira (Moira Replan)	9	
20	Measham Community Centre	7	
21	Ashby Town Hall Mews	7	
22	Measham Road Appleby Magna Scout Site	6	
23	Land Off Ashby Road, Coalville (Scouts)	6	
24	Coalville Recreation Grounds - Ibstock Road Ellistown	6	
25	Cropston Drive Coalville Changing Rooms	6	
26	Melrose Road Recreation Ground - Bowling Pavilion	6	
27	Owen Street Pavilion	6	
28	Melrose Road Recreation Ground - Pavilion	6	✓
29	Scotlands Recreation Ground	6	✓
30	Coalville Park Buildings	6	✓
31	Greenhill Recreation Ground	6	✓
32	Millfield Recreation Ground	6	✓
35	Scotlands Football Pavillion	6	

36	Ramscliffe Community Centre (Donisthorpe)	6	
37	CCTV Office Coalville	5	✓
38	Cropston Drive Coalville Shop and Car Park	3	✓
39	High Street, Ibstock - Public conveniences	1	
40	Coalville Park - Public Conveniences	1	✓
41	Derby Road, Ashby - Public conveniences	1	✓
42	Baker Street Coalville Public conveniences	1	
43	Linden Way Waste Depot	1[49]	✓

The two Council leisure centres are by far the highest emitters of the Council buildings followed by the Council's offices in Whitwick road. The other sites are much smaller.

Figure 12.11 - Key buildings in terms of CO_2 emissions
Sources: Image 1 © G F Tomlinson Group Ltd 2019, Images 2-8 © Google Streetview.

[49] Linden way waste depot appears to be a recycling sorting site with shipping containers only, so estimated very little building operational energy. Any energy used in waste processing is included in 'Waste' category.

Leicestershire County Council Owned property

There are some groups of buildings owned by Leicestershire County Council over which NWLDC have influence. These include hospitals, libraries, churches and schools.

Schools

Schools represent an opportunity to deliver energy savings for the County Council, and to educate those using the buildings about energy efficiency and resilience. In North West Leicestershire there are approximately 165 schools, mostly primary schools, and the schools may be responsible for around 7% of total non-domestic emissions.

Table 12.01 - Numbers of schools in North West Leicestershire

	Number	tCO_2
Independent schools	2	77
Nurseries	42	1,131
Primary schools	109	7,131
Secondary schools	12	4,618
		12,957

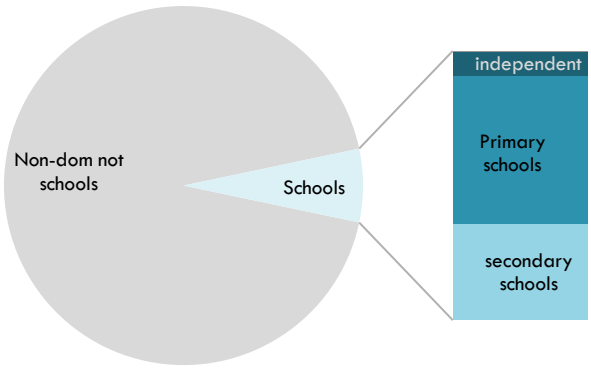


Figure 12.12 - CO_2 emissions from Schools as a proportion of total Non-domestic emissions in North West Leicestershire

12.1.5 Heating systems in North West Leicestershire

As the electricity grid becomes cleaner in the future, the majority of GHG emissions from buildings in North West Leicestershire will be from their heating systems. Understanding and tackling emission from heating buildings will therefore be essential to achieving net zero carbon.

Census data from 2011 indicates that the majority of homes in North West Leicestershire are heated using gas boilers, as shown in Figure 12.13. A more detailed breakdown by Parish is available using an online mapping tool[50].

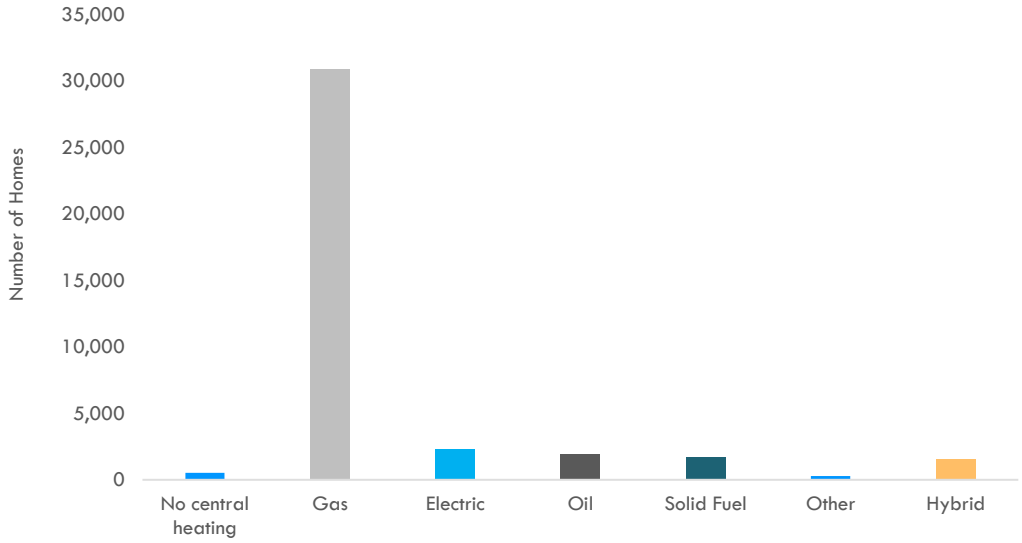


Figure 12.13 – Domestic central heating systems in North West Leicestershire (2011 Census)

In addition to Figure 12.13, it is also necessary to understand the emissions from different types of heating system to fully understand current emissions resulting from heating. Figure 12.15 shows the carbon content of heat produced by the most common heating systems.

It is clear that the widespread use of natural gas for heating is not a plausible option in a zero-carbon scenario as the carbon emissions of even the most efficient modern condensing boilers are substantial. To put this in context, by 2050 the carbon emissions from a typical home heated by gas would be equivalent to the emissions from twenty-five houses heated by air or ground source heat pumps.

While fewer buildings use oil or solid fuels such as coal, they are even higher carbon fuels than natural gas. The combustion of any fuel may also be expected to negatively impact local air quality. Carbon emissions from coal burnt in fireplaces are not included in Figure 12.14 as the emissions would be so high that it would completely skew the scale on the graph. It is also difficult to accurately calculate emissions as the efficiency of open fireplaces is highly variable. Clearly, combustion of coal for heating is not compliant with achieving a zero-carbon goal.

[50] https://www.nongasmap.org.uk/, Kiln, Accessed May 2019

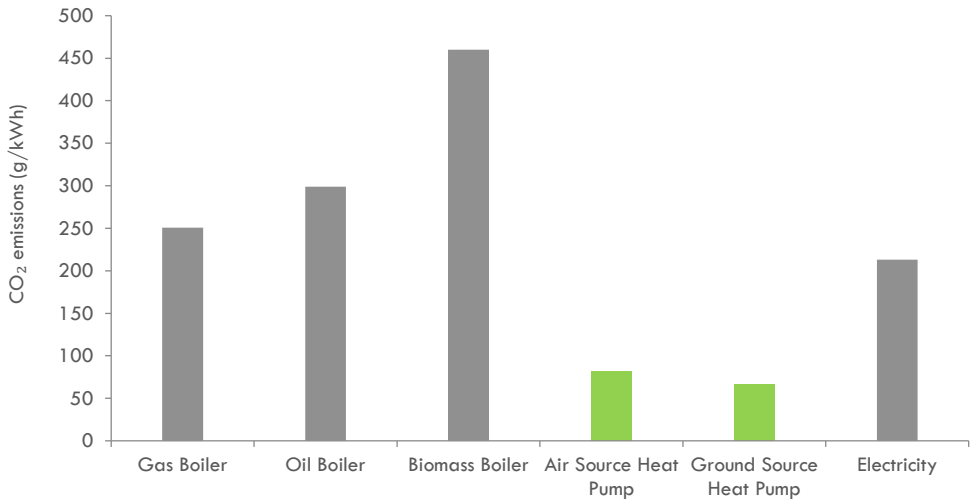


Figure 12.14 – Carbon content of heat from different heat sources

While the carbon content of heat produced by fossil fuels is generally consistent over time, the carbon content of heat from electrically powered heating systems and gas fired CHP varies over time, as shown in Figure 12.15.

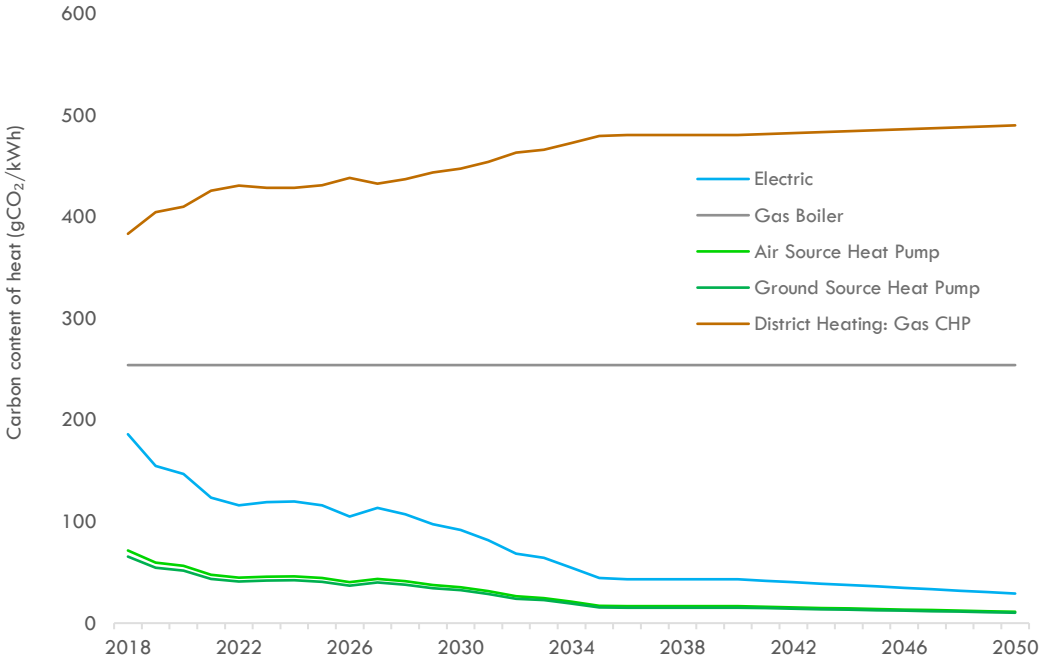


Figure 12.15 – Future carbon content of heat from different heat sources

The reduction in carbon content of heat from electrically powered heating systems results from changes to the mix of technologies used to generate electricity. In simple terms, coal power stations are quickly being retired and wind, solar and potentially also nuclear power are forecast to increasingly displace gas generation. This is reducing the carbon content of electricity and therefore also the carbon content of heat produced using electricity.

The key messages from figure 12.15 are:

- The carbon content of heat from heat pumps is already the lowest of any mainstream commercially available heating technology and is forecast to drop.
- The carbon content of heat from electricity is similar to natural gas boilers but is quickly reducing.
- The carbon content of heat from natural gas boilers is effectively fixed.
- The carbon content of heat from gas fired CHP is already higher than gas boilers and is rapidly increasing.

12.1.6 Challenges

The Housing and Economic Development Needs Assessment (HEDNA) assesses the need for new homes in the District to be more than 9,000 new homes by 2031. The Adopted Local Plan identifies around 9,000 houses for which Planning Permission had been granted or a Resolution to grant had been given. This would represent a 20% increase in the number of homes in NWL. The Plan was written in 2016, so presumably some of that number has now been constructed.

The CCC released a report in February 2019 on the future of housing in the UK, which is largely relevant to the non-domestic sector too.[51] The report's key findings are that climate change targets will not be met without the near-complete elimination of greenhouse gas emissions from UK buildings and that climate adaptation measures for higher average temperatures, flooding and water scarcity, are also lagging far behind what is required. The report concludes that we need to address the '**performance gap**' (ensuring we build to the designed standard), the '**skills gap**' (ensuring those responsible for housing design, construction and in the installation of new technologies are sufficiently well trained) and the '**funding gap**'. We also need to make sure **existing homes** are low-carbon and resilient to climate change and **new homes** should be built to be low-carbon, energy and water efficient and climate resilient.

Heating must effectively be decarbonised by 2050 if net zero emissions are to be achieved due to residual emissions from hard-to-treat sectors such as agriculture and aviation. While some of these sectors, such as the UK's total aviation emissions, fall outside of the scope of this study, the national context is relevant to ensure consistency between NWLDC policy and national policy.

[51] Committee on Climate Change 2019 UK housing: Fit for the future?

12.2 Improving buildings' energy efficiency

GHG emissions from buildings must be reduced by improving building fabric efficiency, decarbonising heating systems and using energy efficient building services. It is also important that electricity supplies to buildings are decarbonised, as outlined in Section 11.

Table 12.02 outlines the typical performance of a building in North West Leicestershire at present, and provides indicative requirements for levels of performance required to achieve net zero GHG emissions.

Building feature	Typical building in NWL	Indicative requirement for net zero carbon
Floor	Uninsulated concrete or suspended timber.	Compact building form to minimise heat loss.
Wall	Inconsistent between buildings. Some may have a modest amount of cavity wall insulation, generally poorly installed with air gaps. Newer non-domestic buildings may be built from insulated panels, typically 100mm thick with highly conductive materials such as metal fastenings bridging the insulation layer.	Minimum of 100mm fibrous or rigid insulation. Ideally 150mm-300mm for ultra-low energy buildings, depending on how compact the building is. Insulation installed neatly with no air gaps and minimal bridging by highly conductive materials, such as metal fastenings.
Roof	Inconsistent between buildings. Typically up to 100mm of poorly installed insulation where present. Up to 300mm on some properties.	300mm of well-installed fibrous insulation where an attic space is available. 200mm of high-performance rigid board acceptable where no attic space available.
Windows & Doors	Single glazing, or double glazing with air filling, metal glazing spacers and no low-e coatings.	Thermally broken frames with triple or very good double glazing. Argon filled units with low-e coatings and warm edge spacers.
Airtightness	Very poor, typically 5-15 air changes per hour at 50Pa.	Good to excellent levels of 0.6-3 air changes per hour at 50Pa.
Ventilation	Uncontrolled: relies on gaps in building structure, trickle vents in windows or opening windows.	Controlled: mechanical ventilation with heat recovery in winter, with natural ventilation in the summer where appropriate.
Heating	Predominantly gas boilers, with some electric heating and use of heat pumps in commercial buildings.	Heat pumps or electric heating.
Renewable Energy	Solar photovoltaic systems installed on some buildings.	Widespread use of solar photovoltaic systems, especially on commercial buildings.

Table 12.02 – Typical building performance in NWL and requirements to achieve net zero carbon

Our preliminary analysis indicates that the existing buildings owned by the Council have very poor levels of building fabric efficiency. As a result, space heat demand is typically in excess of 100kWh/m²/year. Many domestic properties across the district are also expected to have similar levels of space heat demand. For context, a building meeting the world's most advanced fabric efficiency standard, Passivhaus, would have a space heat demand of just 15kWh/m²/year. The space heat demand is typically calculated through energy modelling of buildings using the Passivhaus Planning Package (PHPP), which has been shown to be a robust way of accurately predicting energy performance of both new builds and retrofits.

12.2.1 Improving energy efficiency in existing buildings

Improving the energy efficiency of existing buildings is achieved through retrofitting the net zero compliant measures outlined in Table 12.02 over time. As these interventions represent large investments and can be quite disruptive, they are typically assessed through a strategic retrofit plan. These plans are typically developed for individual buildings, or for groups of similar buildings. Good practice retrofits are typically designed to reduce space heat demand to under 40kWh/m²/year, while best practice retrofit can achieve as low as 25 kWh/m²/year.

A strategic retrofit plan will consider the cost and GHG emission reduction benefits of different measures and efficiently sequence key works over several years or decades to cost-effectively deploy the necessary measures to achieve full decarbonisation. Developing a strategic retrofit plan also ensures that key intervention points in a building's lifecycle are identified in advance so retrofit measures are installed in a logical order. In some cases it may become apparent during development of a retrofit plan that retrofit is uneconomical and demolition and rebuild is a better option.

While it is beyond the scope of this study to explore the subject of strategic retrofits in more depth and retrofit plans vary between buildings, there are some general rules that should be followed:

Energy modelling using a reliable software such as the Passivhaus Planning Package should be used to accurately predict the post-retrofit performance of the building. This also provides a clear indication of the impact of various measures on energy performance, so money can be spent on areas where it has the greatest impact.

Solar panels are often a sensible early step as disruption is very low and they generate immediate GHG emission reductions and from January 2020 a guaranteed revenue stream. An exception to this is in the case of any roofs that may need externally insulating, where the insulation should be applied first in a manner that facilitates subsequent installation of the solar panels.

Decarbonised heating systems such as heat pumps can deliver up to 80% reductions in carbon emissions relative to other heating systems. They often do not reduce energy bills unless replacing electric heating systems. The level of disruption varies, but is generally lower than most fabric efficiency work, with the exception of loft insulation. Heat pumps do not work well in very poorly insulated buildings, so it is usually sensible to carry out some fabric efficiency work before installing a heat pump. Typical measures include loft insulation and floor insulation can be a logical fit if installing underfloor heating.

Windows and doors are typically upgraded when existing ones reach the end of their serviceable life. Due to their long lifespan, relatively high installation costs and levels of disruption to tenants, it is sensible to avoid specifying mediocre products that will later require upgrade. Windows and doors tend to be expensive, however the marginal cost of specifying high performance products is often low if a competitive supplier is selected.

Airtightness should be improved at every opportunity while upgrading the building fabric. Replacing windows and doors is a key opportunity to improve airtightness, as is installing floor or wall insulation. Any major internal retrofit work may also provide an opportunity to improve airtightness. As airtightness levels are reduced, it will become necessary to ensure there is a robust ventilation strategy in place to ensure adequate fresh air supply.

Ventilation should be considered in tandem with airtightness improvements, though the complexity of installing mechanical ventilation systems into existing buildings may dictate the schedule. Fitting mechanical ventilation systems with heat recovery is generally quite costly and disruptive, and is usually reserved for the later stages of retrofit.

Insulation to the roof, walls and floor can occur at any time. The cost and level of disruption is highly variable depending on building type. It is usually sensible to co-ordinate major insulation retrofit work with other measures that are a natural fit, for example it may be sensible to install solar panels straight after external roof insulation has been fitted while scaffold is in place, or to install underfloor heating while insulating a floor. The walls of a building are usually the largest heat loss area and are important to address.

For Council owned housing, the concentration of a large proportion of the housing stock in one place presents a good opportunity to develop strategies and solutions in that one location, building a knowledge and expertise base that can be applied to the smaller developments around the wider district. Given the predominance of one house type – the 3 bed 'semi' – and even though the base condition of these homes are likely to vary with the age of original construction, the development of a consistent specification and approach to upgrade these to at least EPC band C with good cost and programme accuracy will make the 'roll out' robust in both planning and revenue forecasts.

Across the district, retrofits to buildings need to be carried out on top of more general improvements, which are not currently happening. The NWL Housing Strategy 2016-2021 presents many complex challenges in terms of meeting basic need for housing, let alone any improvement to the housing stock. However, it identifies a number of issues where energy efficiency improvements to homes would form part of the solution, for example:

- Reduce fuel poverty across all tenures
- Reduce excess winter deaths
- Create sustainable and inclusive communities where people want to live

The need to retrofit buildings is a nationwide issue, and there are measures that could be taken at a central government level to make it easier, or more appealing, for both landlords and occupants to retrofit buildings and choose energy efficient and low carbon appliances and systems. However, funding streams have been inconsistent in recent years and there has been a lack of capital funding to councils, so it falls to local authorities to find the solutions.

The Council leading by example is recommended as an excellent first step, and is required in any case to achieve the Council's 2030 net zero target. It will help to create demand for key products and services such as insulation retrofits, heat pumps and solar panels. It will also grow expertise within the Council and across the district in the processes involved in decarbonising buildings.

There is potential to work with commercial partners, for example utility companies have obligations to invest in energy efficiency, and engagement with local businesses may encourage them to access this funding.

It is recommended that the Council investigate the potential to adopt specific retrofit standards, such as the Passivhaus Institute's EnerPHit standard, which requires a space heat demand of 25kWh/m^2/year or less, or Energiesprong[52], which permits a space heat demand of 30 kWh/m^2/year or less. Another alternative is the AECB Standard[53] which requires a space heat demand of 40kWh/m^2/year or less. This is very achievable in the majority of buildings and can deliver net zero carbon when combined with a heat pump and solar panels.

12.2.2 Improving energy efficiency in new buildings

Planning policy needs to be updated as a matter of urgency to ensure that all new buildings in North West Leicestershire are built to zero carbon standards. As described in Table 12.02, **this must ensure that new buildings are built with very efficient fabric and services, that they use heat pumps or electric heating and that they have renewable energy systems installed on site where possible.**

It is recommended that the Council immediately commit to ensuring that any new Council owned buildings are built to the Passivhaus Institute's Passivhaus standard, or their Low Energy Building standard. These standards require space heat demands to be no more than 15kWh/m^2/year and 30kWh/m^2/year, respectively. Passivhaus has a comprehensive quality assurance process that has been proven to work across the UK, Europe and globally. By combining the Passivhaus standard with low carbon heating and renewable energy, there is a simple route to zero carbon which requires no carbon offsetting and is therefore more transparent than a traditional building regulations route.[54]

A report recently published by the Green Construction Board (in response to BEIS Buildings Energy Mission to halve energy use in new buildings by 2030 [55]) adopted an evidence-based approach and identified common traits between buildings which achieve at least a 50% reduction in energy use compared to the average equivalent building. This revealed recurring approaches used by most or all of the case study buildings.

Those which are not already included in Table 12.02 include:

1. Contractual energy performance targets.
2. Prediction of future energy use at design stage and during construction[56].
3. Verification of construction and commissioning quality to ensure energy performance is achieved in practice.
4. Operational monitoring and evaluation to ensure design stage energy performance is achieved.

We would recommend including these requirements in the new Local Plan.

[52] Energiesprong is an approach to net zero buildings first developed in Holland that includes a focus on return on investment twinned with a 30-year performance warranty
[53] The Association of Energy Conscious Builders (AECB) standard (previously the AECB silver standard)
[54] The Passivhaus trust 2019, Passivhaus: the route to zero carbon?
[55] Background report to recommendations from the Green Construction Board in response to the 2030 new build challenge, 2019, JGS and Etude
[56] These calculations should include all energy use as calculations performed for compliance with building regulations miss out some key end uses of energy.

12.2.3 Decarbonised heat in NWLDC

While improving the fabric efficiency of buildings is an important strategy to reduce fuel poverty and emissions, achieving zero carbon ultimately requires an end to the use of most carbon-based fuels for heating. This section explores options to decarbonise heating of buildings in North West Leicestershire. Sensible targets would be for the Council to cease installation of fossil fuel-based heating systems immediately, transitioning to heat pumps by 2030, and to work with the private sector to prepare them for the phase out of gas boilers in new builds in 2025.

Heat pumps

Heat pumps are a mature, reliable, and commercially available technology. They are already the heating technology of choice for many commercial buildings in North West Leicestershire. They use electricity to drive a compressor, and in some cases also a fan and/or pump. Operating like a fridge in reverse, heat pumps efficiently move heat from one location to another. They can be used for space heating and/or water heating, though not all heat pumps do both.

As heat pumps only require electricity to operate, they produce no GHG emissions at the point of use. There are GHG emissions associated with electricity required to power them, however these are much lower than for fossil fuel heat sources, and they are quickly reducing so heat pumps provide a viable route to decarbonise heating entirely.

As the amount of heat energy a heat pump can move is usually greater than the amount of electrical energy required to power them, their efficiencies often exceed 100%. For example, if a heat pump required 1 unit of electricity to move 3 units of heat into a building, its efficiency would be 300%. Heat pump efficiency is primarily affected by the difference in temperature between the heat source outside the building and the temperature of heat required within a building.

This means heat pumps are more efficient when used with lower temperature heat emitters such as underfloor heating than they are with higher temperature heat emitters such as radiators. In practice, most buildings are able to operate heat pumps at good efficiencies using radiators at a reasonably low temperature of 45°C providing the building fabric is reasonable energy efficient. Table 12.03 provides typical values of the efficiencies of different types of heat pumps.

Heat Source	Heat Source Temperature	Efficiency delivering 35°C water for space heating with underfloor heating	Efficiency delivering 45°C water for space heating with radiators	Efficiency delivering 60°C domestic hot water
Ground	11°C	390%	330%	280%
Minewater	13 °C	400%	340%	290%
Air	-5-30°C*	260-440%	210-330%	170-330%

**Air temperatures vary throughout the year. Space heating assumes a maximum external air temperature of 15 °C as heating systems will be turned off at higher outdoor temperatures. Water heating considers air temperatures up to 30°C, which could occur in the summer.*

Table 12.03 – Typical efficiency ratings for different heat pumps operating at different temperatures

Many heat pumps contain Fluorinated gases (F-gases). These are powerful greenhouse gases that are tightly controlled within the UK. If the F-gases contained in a heat pump leak into the environment, they can result in similar emissions to a gas boiler operating for an entire year. There are international, EU and UK level agreements in place to reduce the amount of F-gases in use and the heat pump industry is planning a phased transition to gases with much lower global warming potentials.

Direct electric

Direct electric heating systems have low capital costs, are simple and require little to no maintenance. Examples of direct electric heating include night storage heaters, electric panel radiators, electric oil filled radiators, electric fan heaters, electric underfloor heating, electric hot water tanks and electric in-line water heaters. All electric heating systems have efficiencies of 100% as all of the electricity used to power them is turned into heat.

With the electricity grid decarbonising, electric heaters can deliver low carbon heat, however they are less efficient than heat pumps. The use of electric space heating should be discouraged in all but the most efficient buildings as electricity typically costs 3-5 times as much as gas. A good general recommendation would be to only encourage the use of direct electric heating in buildings that meet the Passivhaus standard.

Direct electric water heating is less likely to present an issue in terms of fuel cost as hot water consumption is generally limited by occupancy and behaviour. Heat pumps operate less efficiently at the higher temperatures required for water heating, therefore do not provide as great an advantage over electric water heating as they do for space heating.

Green gas

As described in the section on electricity generation, it is estimated that North West Leicestershire could only produce a very small amount of 'green' gas, relative to the district's demand for heat energy, so it does not provide a scalable solution to decarbonise heating. The Committee on Climate Change generally recommend that in a net zero carbon scenario any use of carbon-based fuels is combined with carbon capture and storage. This is unlikely to be practical at the scale of individual heating systems. It is therefore recommended that 'green' gas is used for centralised electricity generation where it can be co-located with carbon capture and storage facilities, as they become commercially available.

Biomass

Biomass heating generally refers to the combustion of woody biomass such as logs, wood chips or wood pellets. It can provide a very affordable source of heat, with local resource often available for low prices and in some cases scrap wood can be sourced for free. Biomass based heating systems typically require large volumes of fuel and regular ash removal. Combustion of woody biomass results in a range of air pollutants that negatively impact air quality.

The net GHG emissions produced when burning biomass are highly variable[57], and depend on what would have happened to the biomass had it not been burnt. In the case of a growing tree, burning it results in a net gain in atmospheric carbon dioxide, which is often greater than that for most fossil fuels per unit of heat, due to the water content of the wood. If each tree that is burned is replaced and nurtured on a 1 for 1 basis, then over several years or decades carbon dioxide will be removed from the atmosphere and locked up in the biomass of the new tree. This is the basis for claiming that burning biomass is a 'carbon neutral' fuel. In other cases, biomass left to rot may produce methane, which is a much stronger greenhouse gas than carbon dioxide. In this case, burning the biomass may result in a net reduction in GHG emissions. Due to these complexities, and the negative impacts on air quality pursuing biomass heating at scale, or assuming it is a low carbon heat source, are not recommended. As with green gas, the Committee on Climate Change generally recommend that combustion of biomass is co-located with carbon capture and storage, as this results in a net reduction in atmospheric carbon dioxide. This is unlikely to be practical at the scale of individual building heating systems.

Hydrogen

Hydrogen is currently produced via four methods, summarised in Table 12.04. Of these the first three require a fossil fuel feedstock and carbon capture and storage (CCS) to produce low carbon hydrogen. The Committee on Climate Change estimate that hydrogen with CCS can achieve emissions reductions of 60-85% relative to using natural gas.

Process	Global production	Unabated carbon intensity	Cost in 2025
Steam-methane reformation	49%	285 gCO_2/kWh	£28-50 / MWh
Partial oil oxidation	29%	-	-
Coal gasification	18%	675 gCO_2/kWh	£68 / MWh
Electrolysis	4%	0-325 gCO_2/kWh	£89-92 / MWh

Table 12.04 – Sources of hydrogen (Data from UK CCC and IRENA)

The Global CCS Institute reported in 2018 that the majority of CCS capture capacity worldwide is used for Enhanced Oil Recovery (EOR), indicating that the co-production of fossil fuels may form an important part of the economic case for CCS. Economically viable non-EOR CCS will therefore be required for hydrogen to become low carbon. Production of hydrogen via electrolysis powered by very low carbon sources of electricity such as renewables and nuclear offers a more plausible route to create low carbon hydrogen. Relative to heat pumps,

[57] Chatham House (2017) *Woody Biomass for Power and Heat: Impacts on the Global CLimate*

costs are likely to be high and production capacity ultimately limited as a result of the inefficiencies of the Hydrogen supply chain, shown in Figure 12.16.

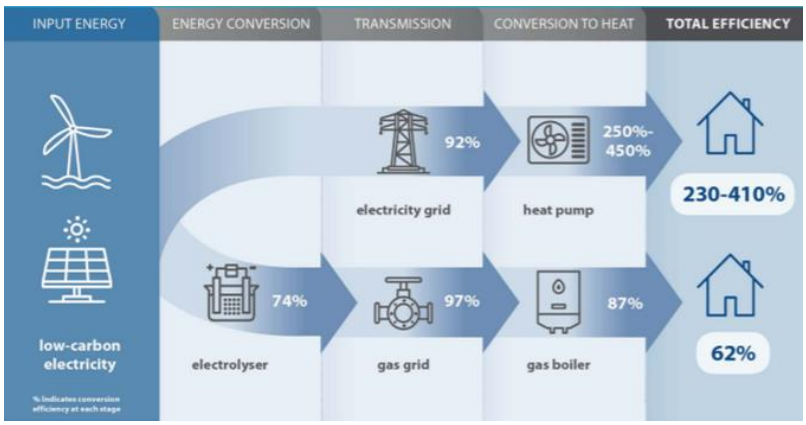


Figure 12.16 – Process efficiency of heat pumps vs hydrogen boiler (© Committee on Climate Change, 2019)

The Committee on Climate Change sees a limited role for heating buildings with hydrogen where '*electrification reaches the limits of feasibility and cost-effectiveness*'. In practice, this is likely to mean top up heating for a small number of buildings on very cold days. This view is based on a maximum potential capacity to produce 44TWh of hydrogen a year via electrolysis by 2050, less than 10% of current gas consumption in buildings. Limited hydrogen supplies will also need to be used for hard to treat sectors such as industrial process heat, back-up power generation and heavy-duty vehicles. There does not appear to be a significant role for heating buildings with hydrogen in North West Leicestershire based on these considerations.

Gas fired CHP

As shown in Figure 12.15, the carbon content of heat produced by Gas fired Combined Heat and Power (CHP) systems is significantly higher than gas boilers and is increasing as the electricity grid decarbonises. This is because these systems rely on offsetting emissions from the electricity they generate based on not having to use electricity from the national grid. As the carbon content of grid electricity has fallen, this offset has diminished exposing Gas CHP as a high carbon heat source, which is not compliant with reaching net zero carbon. New developments across the district should not use Gas CHP with immediate effect. The use of existing gas CHP should be phased out across Council buildings by the late 2020's to ensure net zero is achievable, and on a district wide basis as soon after as is practical.

13.0 TRANSPORT

Emissions from transport currently accounts for more than a third of the total emissions in North West Leicestershire, so addressing this is a key part of the carbon reduction strategy. The factors affecting transport emissions are the quantity of vehicles and the carbon intensity of the energy source. Predicted population growth combined with an increase in per capita vehicle ownership point to an increase in total vehicle numbers as we move forwards towards 2050. So, naturally, the focus is the power source, and a shift from fossil fuel powered to electric vehicles is a clear solution, with the co-benefits of reducing air and noise pollution.

In North West Leicestershire private car use is 15% higher than the national average and commuting by public transport is just 20% of the national average. In this context it is also difficult to envisage a future for NW Leicestershire in which public transport plays a major role, but opportunities should still be explored for development of existing and new public transport routes where these are strategically appropriate. Additionally, the potential of cycling and walking to reduce emissions through elimination of short journeys should be embraced, particularly given the additional health and social benefits.

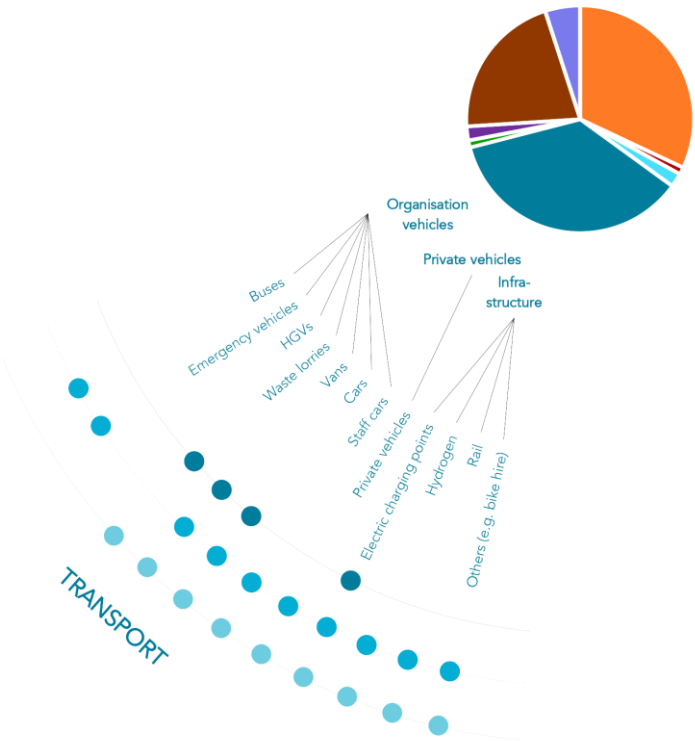


Figure 13.01 - Transport decarbonisation efforts in NWL in the context of the overall carbon reduction strategy

13.1 Transport: national context

The Committee on Climate Change sets out a strategy for the reduction in transport emissions nationally[58], identifying emissions reductions achievable for different vehicle types to deliver a net-zero target by 2050. This included recommendations for the electrification of vehicles and reduction of vehicle miles through a shift to

[58] Committee on Climate Change, Net-zero technical report, May 2019

walking, cycling and public transport, and potential logistics improvements and behavioural changes to reduce the distance travelled by heavy goods vehicles (HGVs).

13.1.1 Electrification of vehicles – ambitions

Electrification of vehicles is the key mechanism for reduction in transport emissions. This is due mainly to the current high emissions from cars and vans, but there are also electrification options for freight vehicles and public transport, which will be necessary to achieve net zero emissions from transport by 2050.

Cars and vans The Department for Transport's '*Road to Zero*' Strategy[59] set an aspiration for "*at least 50%, and as many as 70%, of new car sales and up to 40% of new van sales being ultra-low emission by 2030*". This builds on previous pledges to end the sale of all new conventional petrol and diesel cars and vans by 2040[60]. The CCC report takes this further, recommending that only fully electric and plug-in hybrid cars and vans eligible for sale post-2035, and regulatory approval for fossil fuel cars, vans and motorbikes limited after 2030.

Freight The CCC report recommends that nearly 100% of sales of HGVs are zero emission by 2040. Smaller HGVs are now commercially available[61]. For larger rigid HGVs and articulated HGVs electrification options are a little more complex due to increased power requirement, but include a mix of hydrogen fueled HGVs, electrified HGVs with pantographs recharged by on-road catenary systems ("e-highway" [62]) or electrified HGVs with extremely powerful chargers located at motorway service areas.[63]

Public Transport The CCC report recommends that bus and coach sales must be fully zero emission by the year 2040, with about 50% of new vehicle sales being zero emission by 2030. The CCC also recommends the introduction of 'taxi-buses', which are shared 'on demand' fleets of electric vehicles with increased occupancy. Emissions from rail are required to reduce by 55% by 2050, which includes electrification of 54% of rail track by 2040 on the busiest lines and hydrogen trains deployed on less busy lines.

[59] Department for Transport, The Road to Zero, July 2018
[60] Department for Environment Food and Rural Affairs & Department for Transport, UK plan for tackling roadside nitrogen dioxide concentrations, July 2017
[61] For example the eActros heavy-duty electric truck from Mercedes-Benz
[62] https://interestingengineering.com/germany-open-its-first-ehighway-system-for-trucks
[63] Committee on Climate Change, Net-zero technical report, May 2019

13.1.2 EV cars - benefits and barriers

Over a 10,000-mile journey Electric Vehicle (EV) cars charged from UK mains electricity emit approximately 0.96t CO_2e, which is less than a third of the emissions of an equivalent petrol or diesel car, and this will reduce further as the grid decarbonises. EV cars also eliminate local air pollution and are much quieter. The UK government offers grants for the cost of the vehicle[64] and the charging point[65].

Despite the benefits, electric and hybrid electric cars currently represent less than 2% of total cars registered in the UK[66]. Barriers to uptake[67] include the high costs of EVs, which can be up to 50% more than the cost of a fuel powered car even with grant funding, but market projections suggest that EVs could reach price equivalency by the mid-2020s.

Battery capacity and lack of charging points are also perceived to be a barrier. However, battery technology is improving, with many vehicles now having a range in the region of 220-300 miles[68].

Manufacturers have set their own targets for new sales percentages of sales to be EVs and these vary significantly by supplier as shown in the table below.

Manufacturer	Timing	Commitment
Nissan	2025	Battery electric vehicles (BEVs) 50% of sales in Japan and Europe
Mercedes	2025	BEVs 15 - 25% of sales
VW	2025	EVs 25% of sales
Porsche	2030	EVs 100% of sales
Toyota	2030	EVs and conventional hybrids 50% of sales
Volvo	2030	EVs and conventional hybrids 50% of sales
Honda	2030	BEVs, plug-in hybrid electric vehicles and hydrogen vehicles 15% of sales

Table 13.01 - Manufacturer commitments on electrification

[64] Low-emission vehicles eligible for a plug-in grant
[65] Office for Low Emission Vehicles Electric Vehicles, Homecharge Scheme – Guidance for customers: January 2019
[66] Department for Transport, Vehicle Licensing Statistics Table VEH0203 – Licensed cars at the end of the year by propulsion / fuel type, Great Britain from 1994; also United Kingdom from 2014
[67] House of Commons Business, Energy and Industrial Strategy Committee, Electric vehicles: driving the transition Fourteenth Report of Session 2017–19
[68] eg Nissan Leaf E-plus, Renault Zoe 2019, Tesla Model 3 etc.

13.1.3 EV charging infrastructure

The majority of EV charging can be accommodated outside peak demand hours and within existing network capacity, provided that customers are appropriately incentivised to shift their charging and that the appropriate technical solutions/market frameworks are in place. Charging possibilities are

- *Overnight home charging*
- *Street charging* – e.g. from a lamppost
- *E-highway* – with on-road catenary systems and access to chargers at regular intervals
- *Motorway charging* – during a long-distance journey using on-demand rapid charges on motorways or other strategic destinations and/or as part of existing fuel retail network
- *Work place charging* – potential V2G application (described below)
- *Destination charging* – supermarkets, leisure centres, gyms
- *Fleet charging* – as a commercial operator, there must be a possibility to charge the fleet of taxis or delivery vehicles at a central hub.

Most EVs are charged overnight. Data from charging stations show that they are used more on weekdays than weekends, implying that EV usage is linked to work/commuting. In addition, when they are used depends on location. In some places evening charging predominates, whereas in others morning charging is more common. The usage of fast and normal charging infrastructure differs. Fast charging is comparable with refuelling. Fast chargers are used in two different ways: a "top-up" of up 10 minutes, and longer charging sessions of 10-30 minutes. The charging point's location affects what type of behaviour predominates.

13.1.4 EV cars as batteries

In 2018, EDF Energy announced a partnership with a leading green technology company, Nuvve, to install up to 1,500 Vehicle to Grid (V2G) chargers in the UK. The chargers will be offered to EDF Energy's business customers and will be used at its own sites to provide up to 15 MW of additional energy storage capacity (that is the equivalent amount of energy required to power 4,000 homes). The stored electricity will be made available for sale on the energy markets or for supporting grid flexibility at times of peak energy use. EDF Energy is the largest electricity supplier to UK businesses and its partnership with Nuvve could see the largest deployment of V2G chargers so far in this country. However, in order for V2G to work, it must be on a large-scale basis. Power companies must be willing to adopt the technology in order to allow vehicles to give power back to the power grid, and the consumers need to demonstrate demand for the technology

13.1.5 Reduction in vehicle miles

The CCC report recommends a shift of 10% of car miles to walking, cycling and public transport, and alongside this suggests a national strategy to address the decline in bus usage is required. It is also noted that wider availability of electric bikes, scooters and cargo-bikes may reduce car use for those who find walking or non-electric cycling difficult.

A reduction in freight transport distances is also possible, and the CCC report recommends that logistics improvements are made to reduce HGV km by approximately 10%, for example by expanded use of urban consolidation centres and extended delivery windows. Deep reductions in HGV miles could be driven by societal changes in the way we produce and consume goods, by repairing, refurbishing, re-using, reducing consumption and volumes of waste, and producing goods locally.

13.2 Transport in North-West Leicestershire

13.2.1 Vehicles: The Council's fleet

There are 153 vehicles in the NWLDC fleet, which is less than 1% of the total vehicles in North West Leicestershire, as shown in Figure 13.02. Of these, the majority are vans (65) followed by lorries (34), there are 12 cars and 42 'other' vehicles, which includes diggers, light tippers, mechanical sweepers, mini tractors, ride on mowers, recycling and refuse vehicles.

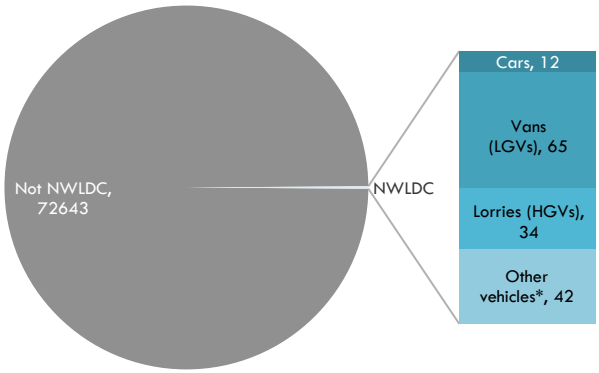


Figure 13.02 - Number of NWLDC owned vehicles compared total in North West Leicestershire

13.2.2 Vehicles in NW Leicestershire

Figure 13.03 below shows the current number and breakdown of vehicle types in North West Leicestershire, and the predicted growth of total numbers to 2050. The predicted growth gives the mean, upper and lower predicted ranges (34%, 51% and 17%) due to a number of variables including economic growth, technological advances and behaviour.

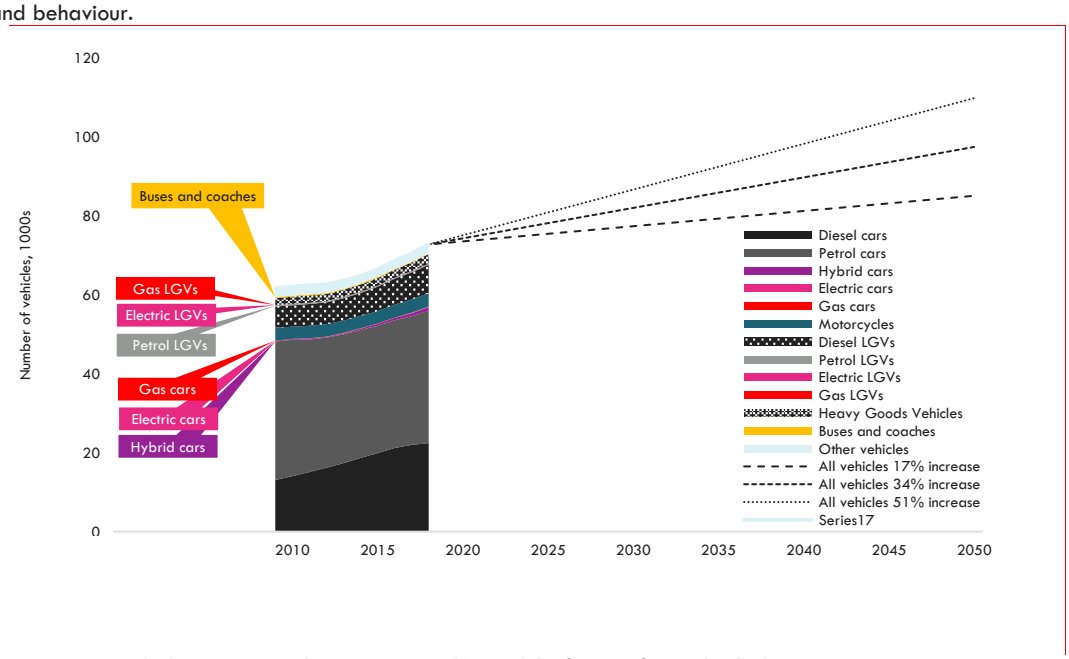


Figure 13.03 - Vehicle types in North West Leicestershire and the forecast for total vehicles to 2050.
Sources: Department for Transport, The Office for National Statistics

Like the rest of the UK, North West Leicestershire is heavily reliant on cars as a form of transport. Cars make up 78% of the total number of vehicles and are responsible for 82% of transport emissions in North West Leicestershire. Private car use is also the dominant mode of transport for commuters, almost 70% compared to 60% regionally and 55% nationally, with the average distance travelled to work is a little higher than the national average – 14.5km vs 13.5km.

Freight Freight contributes to 13.5% of transport emissions in North West Leicestershire.

Public transport Public transport currently accounts for less than 1% of transport emissions in North West Leicestershire. The proportion of people who travel to work on any mode of public transport is half that of the East Midlands generally and around 20% of the National average. **The only**

public transport option is currently busses, with rail in the district used solely for freight. The bus service is controlled at county level and subcontracted to *Traveline*.

Walking/cycling Current projects are under way to improve cycling and pedestrian facilities across North West Leicestershire. Plans focus on the cycle network in and around Coalville, Ashby de la Zouch and the surrounding area, as well the Northern Parishes. The strategy seeks to identify a potential network of cycle links to enable more people to cycle as a regular mode of transport. Other measures such as cycle training, publicity and cycle storage are also identified, which should further encourage use of any infrastructure that is provided.

Transport planning

The Leicestershire Local Transport Plan 2 & 3 is a long-term strategy has been created for 2011-2026.

The Leicester and Leicestershire Integrated Transport Model (LLITM) is a computer-based programme. It can be used to inform development of transport and land-use policies/strategies and look at proposed housing growth and transport infrastructure to assess the environmental impacts, namely air quality, noise and CO_2 emissions.

13.3 Transport: actions towards Zero Carbon for NWLDC

By 2050 carbon emissions from transport in the district will have to reduce to zero or close to zero.

The primary mechanism is the electrification of transport, particularly electric cars. These reduce carbon emissions per vehicle by two thirds at today's grid carbon intensity and towards zero as the grid decarbonizes. **The secondary mechanism is reduction in vehicle miles** through logistics efficiencies and behaviour change, which has knock-on health and social benefits and reduces congestion.

13.3.1 The electrification of transport - Vehicles

As discussed in section 13.1.1 above, there are clear carbon benefits to electrification of transport. As a starting point **the 12 cars and 65 vans owned by the Council should be replaced by EV equivalents**, this would not only reduce the entire fleet emissions by around 27% at current grid intensity (41% with a decarbonised grid), but also would send a clear message to residents and businesses in the district and encourage private uptake of EVs. Another priority should be **replacement of the 21 waste management vehicles with EVs**. These have been tested in the UK, for example in Manchester and London, and there are more and more models being unveiled each year. An example from *Electra* is shown in Figure 13.04. *Electra* are also developing a range of other vehicles.

The potential should be explored for the **electrification of the Council's 42 other vehicles**, which includes diggers, light tippers, mechanical sweepers, mini tractors and ride on mowers, as the EV industry is constantly evolving, and NWLDC may have the opportunity to be pioneers in the deployment of a particular type of EV.

Figure 13.04 - Electric waste collection vehicle from Electra © Electra

The early electrification of the Council's own fleet would enable NWLDC to influence the County Council and subcontractors in providing EV business and service vehicles, such as ambulances and busses. Beyond this the Council could have a minor influence on decisions made by freight businesses operating in the District to electrify their fleet. Some of the large distribution centres which have solar installations in place or planned should be encouraged to integrate EV HGVs into their energy system.

Information to NWL residents and businesses should be given about electric cars, this could be in the form of leaflets or workshops. The Council's own fleet could be used as examples. Incentives for staff to purchase EVs should also be considered.

13.3.2 The electrification of transport – Charging points

The charging infrastructure is key to the success of EV uptake. NWLDC are currently developing a car parking strategy for the District which should address supply, charging and management.

As a priority **the Council should provide work place charging.** This would be necessary for the fleet cars and would also help encourage Council staff to purchase EVs. There is also the potential to use Vehicle to Grid (V2G) technology to sell electricity back to the National Grid. **Fleet charging will also be required** as the range of EV vehicles expands, and it may also be possible to extend this provision to non-fleet vehicles and commercial EV operators. **The Council should also provide Street charging** with EV charging lamp posts (an example is given in Figure 13.05 below) to provide "top-up" charging.

Figure 13.05 - Street charging at a lamp post © www.thechargingpoint.com

The Council can also influence the choices of businesses operating in the region, for example by encouraging the provision of ***destination charging*** at supermarkets, leisure centres and gyms and **electric charging points at existing petrol stations and private carparks**. The Council can also influence the provision of **electric charging points on LCC owned highways**, and support the development of "**e-highways**" that enable electric HGVs to draw energy through electrified cables (see figure below), these highways would also have on-demand rapid charges at regular intervals.

13.3.3 The electrification of transport: cars as batteries in tomorrow's smart grid

The potential of Vehicle to Grid (V2G) chargers to provide EV owners with additional income and to regulate the grid supply is encouraging. Early uptake of this technology by NWLDC would help demonstrate the Councils commitment to sustainable transport and would demonstrate demand to power companies, and therefore support the uptake nationally.

As noted above, some of the large distribution centres with solar installations could be further incentivised to integrate EV HGVs into their energy system, with V2G technology making this more financially attractive.

14.0 WASTE

Waste and treatment of waste results in greenhouse gas emissions. Tackling these emissions will form part of any strategy towards zero carbon. The sources of emissions from waste include:

- Methane emitted during the **decomposition of biodegradable waste in landfill**
- Composting and biological **treatment of waste**
- **Incineration of waste**
- **Treatment of waste water**

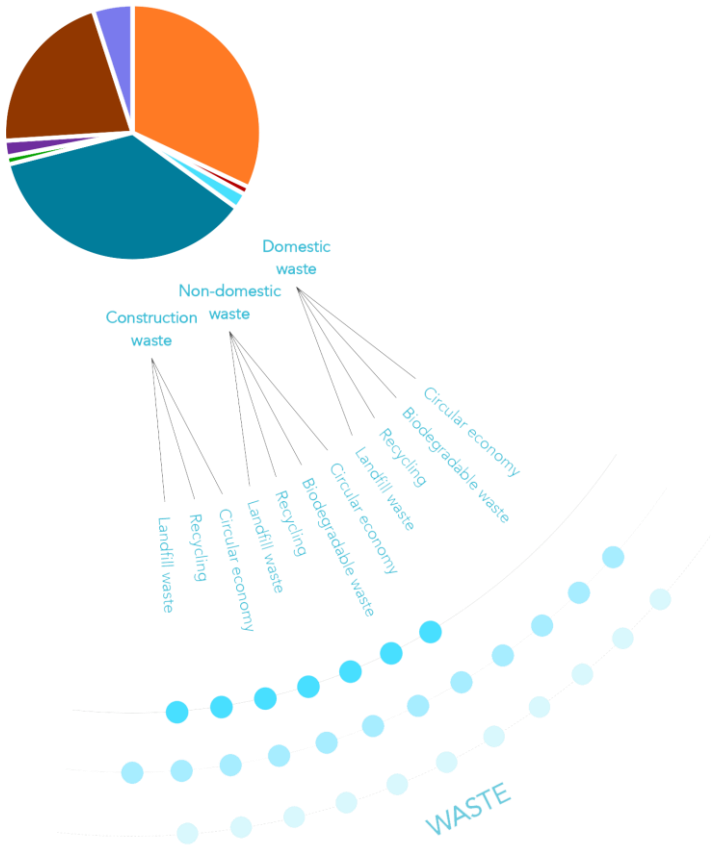
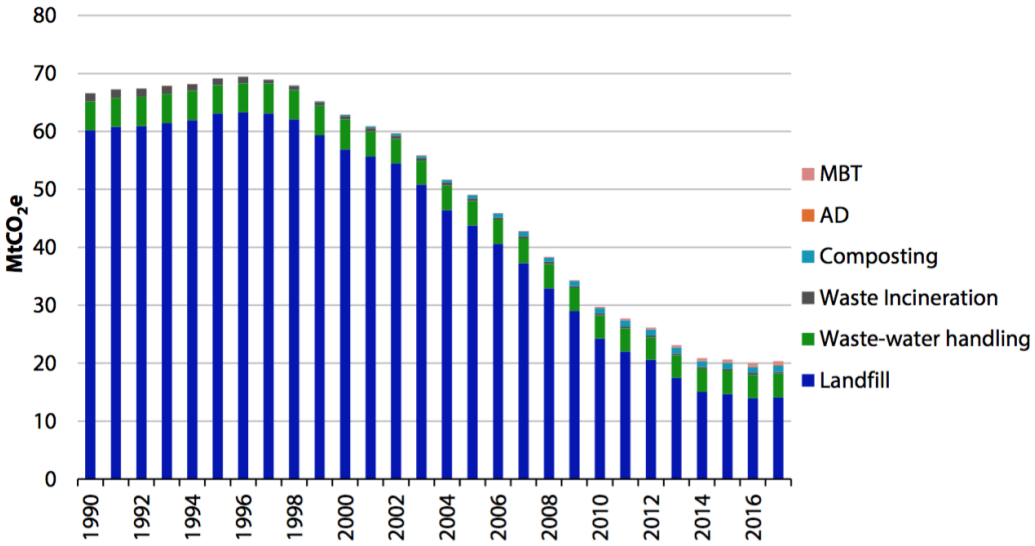


Figure 14.01 - NWLDC waste decarbonisation efforts in the context of the overall carbon reduction strategy

14.1 Waste: National context

In 2017 GHG emissions from waste accounted for 4% of UK GHGs, at 20.3 $MtCO_{2e}$, 92% of which is methane.

The waste sector has achieved a 70% reduction in GHG emissions between 1990 and 2017. This has been achieved mostly through a reduction in organic waste to landfill, methane capture and improved management at landfill sites.



Source: BEIS (2019) *Final UK greenhouse gas emissions national statistics 1990-2017.*

Figure 14.02 – Greenhouse gas emissions from Waste
Source: Committee on Climate Change's Net Zero Technical Report (2019)

14.2 Waste: context in North West Leicestershire

North West Leicestershire District Council is responsible for collecting waste while Leicestershire County Council is responsible for waste disposal.

14.2.1 What happens to NWL's waste?

'Recycle more…'

North West Leicestershire District Council introduced the 'Recycle more…' plan in 2019. It looks at how to increase recycling rates in the district, reduce what goes to landfill and sets out initiatives to do this. 'Recycle more…' sets a target of household recycling rate of 50% by 2022. It looks at barriers to recycling, has conducted resident surveys to understand recycling better and has looked at exemplary case studies where other councils have achieved or are targeting excellent resource use. A number of excellent initiatives have been identified, including partnerships with Leicestershire County Council, schools, businesses and the community.

Non-recyclable waste

Non-recyclable waste is collected and either taken to landfill or incinerated. Non-recyclable waste is dealt with at county level and Leicestershire County Council are responsible for landfill tax.

The last remaining landfill site in North West Leicestershire was decommissioned at the end of 2018. Landfill waste from the district has since been taken outside of the district. It is important however that NWL takes responsibility for the non-recyclable waste they produce and the GHG emissions that result from it.

Domestic waste recycling

North West Leicestershire operate a segregated kerb-side recyclable waste collection service. Waste streams collected and recycled include:

- Garden waste
- Paper
- Cardboard
- Tins, cans and foil
- Plastics
- Glass
- Textiles
- Batteries and mobile phones.

North West Leicestershire currently have a contract with Leicestershire County Council to manage and recycle their own recyclable waste. They have a Council owned facility in Coalville where different recyclable waste streams are separated into different groups.

NWLDC request that residents pre-sort their recycling and use the provided blue and yellow bags, red boxes and brown bin to segregate recyclables before collection by the waste collection crew. NWLDC say this enables waste collection crews to more easily identify contamination at the point of collection, resulting in a higher quality of recyclable waste and therefore better prices from re-processors. NWLDC currently make £500,000 per annum by selling recyclable waste for re-processing.

Given recent publicity regarding the recycling of plastics specifically, the sale of recyclable waste needs to be carefully monitored in order to ensure no reputational impacts arising from waste from the district being shipped in quantity out of the UK unless to known, quality-controlled recycling facilities.

Over the period 2013-2018 recycling rates in the district plateaued at around 46-47%. In 2019 the Council introduced a campaign entitled 'Recycle more…', the objective being to increase the district's recycling rate to 50% by 2022.

The Council ran a mini survey of 150 streets across almost every town/village/area in the district over two consecutive recycling collections. Streets were selected using a multitude of sectors including, housing type, wards and economic status. The results of the survey showed that between different streets there were varying uptakes of the recycling service, ranging from 20-83%. The result of this survey has led to the council employing a dedicated Waste Communication and Engagement Officer as of 1st July 2019, to increase recycling habits of residents across the district.

Domestic food waste

North West Leicestershire District Council are starting a pilot food waste collection scheme in 2019, which will run for a minimum of 6 months. If the trial is successful a full rollout of food waste collection will be implemented in 2021.

Food waste will be taken to a dedicated bio-energy generation plant, which will turn the food waste into gas for electricity generation, and a digestate to improve agricultural soil.

Commercial waste and recycling

North West Leicestershire District Council operates a commercial waste and recycling collection service for different sized businesses. Businesses are required to pay for their waste collection, depending on the amount of waste generated. This is the same for both non-recyclable and recyclable waste.

Food waste is not currently collected from businesses; however, this could be introduced on Mondays since there is current capacity in the food waste collection vehicles to operate on that day.

Waste water

Waste water is dealt with by Severn Trent (ST) water, who cover a large area of the East Midlands. As a large business, ST are required to report carbon emissions and to set/measure targets to reduce their business emissions.

Data is published on the ST website, but it is not comprehensive (latest data is 2015) or broken down in a way that would allow NWLDC to determine what part of the total is attributable to the district. Therefore, the interrogation of that information is of limited direct use in the management of the NWL emissions.

Planning Policy sets some standards, including the use of Sustainable drainage systems and equipment on sites. Reducing surface water run off entering the sewers will make the management of foul sewerage – the element that produces most GHGs – to be better controlled, more precise and more effective. Close liaison between those setting the Planning policy and ST Water is essential and it may be necessary to update or amend general and national Planning Policy to reflect specific local infrastructure issues.

NWLDC could apply some greater pressure to ST Water to publish up to date information and to set more ambitious targets than they are currently doing, by asking them to report directly to council meetings on progress and plans.

Agricultural waste

Agricultural waste is generally dealt with on-site on a farm by farm basis.

Construction and demolition waste, mineral waste and hazardous waste

These waste streams do not produce greenhouse gas emissions and therefore are not discussed in this report. However, re-use and recycling of some of these waste streams could lead to an indirect reduction in GHG emissions as a result of reduced demand for virgin materials. Current Policy
Draft Leicestershire Minerals and Waste Local Plan

The draft Leicestershire Minerals and Waste Local Plan is currently under examination, and when adopted will replace, amongst other documents, the 'Leicestershire and Leicester Waste Core Strategy' and 'Development Control Policies DPD' (both of which were adopted in October 2009).

The draft Leicestershire Minerals and Waste Local Plan identifies that there is the need for additional waste processing capacity in the county as a whole and supports this through the creation of policies that promote the creation of new waste management facilities.

The draft plan does not address wastewater.

North West Leicestershire Local Plan

The North West Leicestershire Local Plan defers to the Leicestershire Minerals and Waste Local Plan for the bulk of its waste policies.

There are however policies within the local plan that address the provision of waste and recycling facilities in residential and non-residential developments. Within the Local Plan, 'Policy D1 – Design of New Developments' states that:

- "New development should have regard for sustainable design and construction methods"

The Local Plan goes on to recommend ways in which sustainable design and construction could be achieved, including:

- "Incorporating waste reduction and recycling measures through the design of the development to ensure there are appropriate storage and segregation facilities".

14.3 Waste: actions towards Zero Carbon for NWLDC

The Committee on Climate Change published a roadmap to Zero Carbon 2050 for the UK in May 2019. The key recommendations for the waste sector include:

- Zero organic waste to landfill by 2025 (5 years earlier than the current UK target)
- Mandatory food waste collection by all councils by 2023, to allow users time to adjust
- A 20% reduction in avoidable food waste by 2025
- Recycling rate of 70% by 2025
- Policies and incentives that encourage the development of low-cost options to improve operational efficiencies in the treatment of waste water in the early 2020s, allowing for more advanced and novel technologies to develop in the 2030s and 2040s

The introduction of the food waste collection scheme to North West Leicestershire should be commended. Following the 6 months pilot period, full commitment should be given to making this a permanent scheme, to be rolled out across the district. It is likely that central government will follow the Committee on Climate Change's recommendation and make food waste collection schemes by local authorities mandatory by 2023, in line with their analysis that concludes that we must achieve zero organic waste to landfill by 2025. Making the food waste collection scheme permanent, puts NWLDC in a strong position of leadership and sets an excellent example to neighbouring districts, who in time may well wish to join the scheme also.

14.4 Other reasons to act

Additional benefits

- Landfill ban on organic waste will save money
- Increase in recycling rate could generate further income for NWL
- Reduction in overall waste will infer reduced transport emissions
- Reduction in food waste means a reduction in demand for food and a reduction in the GHG emissions associated with producing food

Price of inaction

- Delaying implementation of policies and actions will put additional pressure on the Council to achieve any policies and regulations imposed by central government at a later point in time
- Missed opportunity to act as a regional leader in food waste collection

15.0 FORESTRY AND LAND USE

The National Forest is a great asset of North West Leicestershire and will play a vital role in achieving Net Zero. Forested area needs to more than double from current levels. A large part of the strategy towards achieving zero carbon for the UK as a whole involves the need to absorb and lock-in CO_2 from the atmosphere. By planting trees – *creating and extending woodland and forests, and increasing the number of trees in urban areas and farmland* – CO_2 is absorbed from the atmosphere during their growth and locked into both the trees themselves and the soil in which they grow.

The creation and maintenance of peat sequesters carbon. Using it, or degrading peat lands, releases Greenhouse Gases. Restoration and maintenance of peatlands, both upland and lowland is a key part of both emissions reduction and carbon sequestration strategies for the UK as a whole.

Agriculture produces a relatively small proportion of total GHG emissions, but that proportion is intractable and will be very difficult to displace or even substantially reduce. The Committee for Climate Change have put forward proposals for reduction of emissions in the sector, but even their most ambitious ideas do not produce net zero by 2050. This places more pressure on other sectors to reach net zero and on the Land Use change element of this sector to sequester more carbon in order to locally offset the residual emissions from food production.

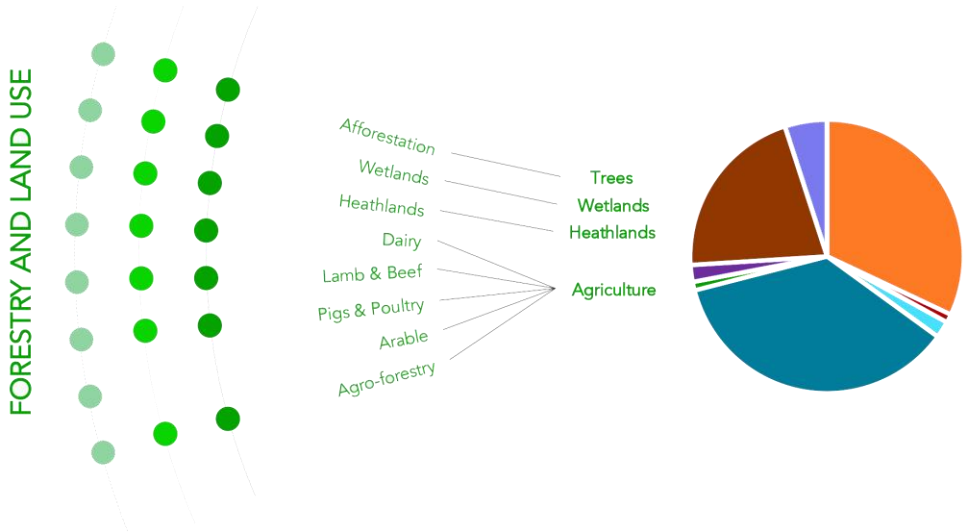


Figure 15.01 - Forestry and land use decarbonisation efforts in the context of the overall carbon reduction strategy

15.1 Agriculture, Forestry and Land Use: National context

Agriculture

The Committee on Climate Change's analysis shows GHG emissions in the agriculture sector were 45.6 $MtCO_2e$ in 2017, accounting for 9% of all UK emissions.

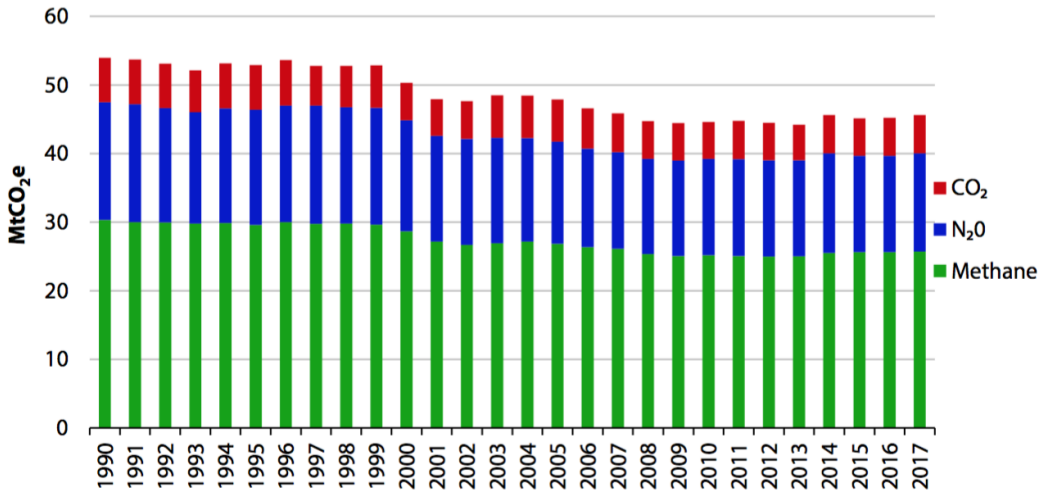
In 2017 methane accounted for 57% of agricultural emissions, NOx 31% and CO_2 12%.

Emissions sources for 2017 can be broken down as follows:

- Livestock – 47%
- Agricultural soils -25%
- Wastes and manures – 15%
- Mobile machinery – 9%
- Stationary machinery – 1%.

Emissions reductions in the agriculture sector are not falling as fast as other sectors - it is seen as a 'hard to treat' sector. The largest decrease was seen between 1998 and 2008 and was due to reforms in the Common Agricultural Policy (CAP) leading to a reduction in livestock.

It is not possible to reduce non-CO_2 GHG emissions to zero in the agriculture sector due to the nature of natural processes emitting methane.



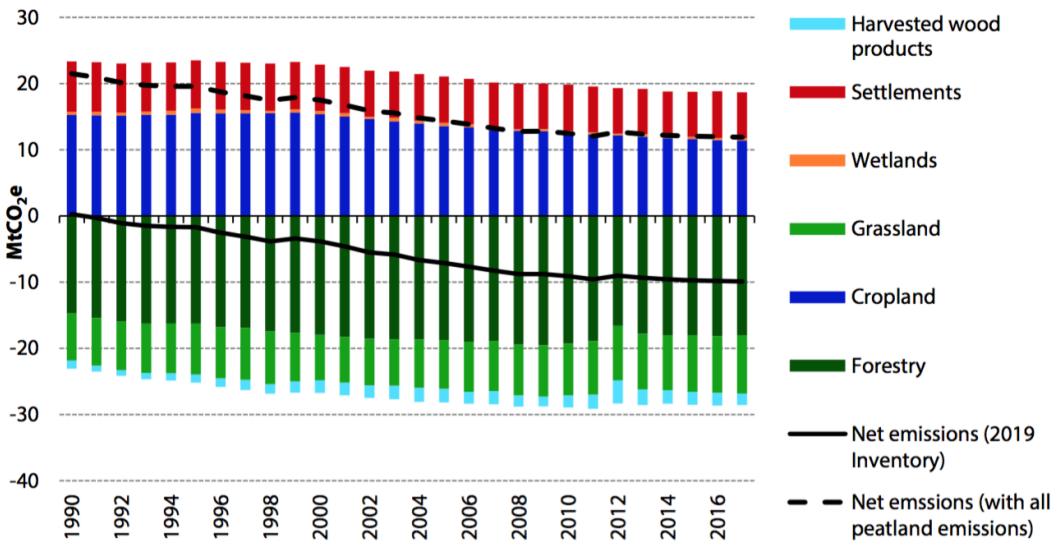
Source: BEIS (2019) *Final UK greenhouse gas emissions national statistics 1990-2017.*

Figure 15.02 - GHG Emissions from Agriculture, source: CCC Net Zero Technical Report, 2019.

The Committee for Climate Change suggest that national policy changes will be needed to substantially reduce Agriculture sector emissions. The implementation of changes to farming practices and in particular R&D investment to establish breeding programmes and changes to ruminant (cows and sheep) diets require certainly national, and probably international, collaboration.
Reducing the number of farm animals is a key part of the strategy for emissions reductions and that is a locally implementable element, requiring behaviour change by private citizens but which can be led by the local authorities setting an example.

Land Use and Forestry

The LULUCF sector was a net carbon sink in 2017, locking up 9.9 $MtCO_{2e}$, or around 2% of UK emissions.



Source: BEIS (2019) *Final UK greenhouse gas emissions national statistics 1990-2017*; Chris Evans et al. (2019) *Implementation of an Emissions Inventory for UK Peatlands.*
Note: Estimates of net emissions (with all peatland emissions) is based on the higher value for forestry peat.

Figure 15.03 - GHG emissions from Land-use, Land-use Change and Forestry Sectors. Source: CCC Net Zero Technical Report, 2019.

The Committee for Climate Change highlights afforestation, better forestry management especially of broadleaf woodlands, and alterations to land use from conventional farming practices as the main elements of a strategy to improve the performance of this sector.

15.2 Agriculture, Forestry and Land Use: context in North West Leicestershire

Agriculture

North West Leicestershire supports a mixture of arable, market garden and livestock farming. According to the Adopted Local Plan, the agriculture sector in North West Leicestershire is forecast to decline over the period 2012-2031. According to BEIS data, agriculture accounts for around 7% of GHG emissions in North West Leicestershire

Land use and Forestry

The National Forest covers 15,520 hectares of North West Leicestershire's 27,900 hectares, 56% of total land area. The goal of the National Forest is for woodland to occupy one third of the land within it, equivalent to 4,656 hectares. A total of 3,634 hectares of woodland was reported in the National Forest in 2016[69], compared to just 637 hectares before the project began. A further 847 hectares of other woodland exist in other areas in the district, bringing the total wooded area to 4,481 hectares.

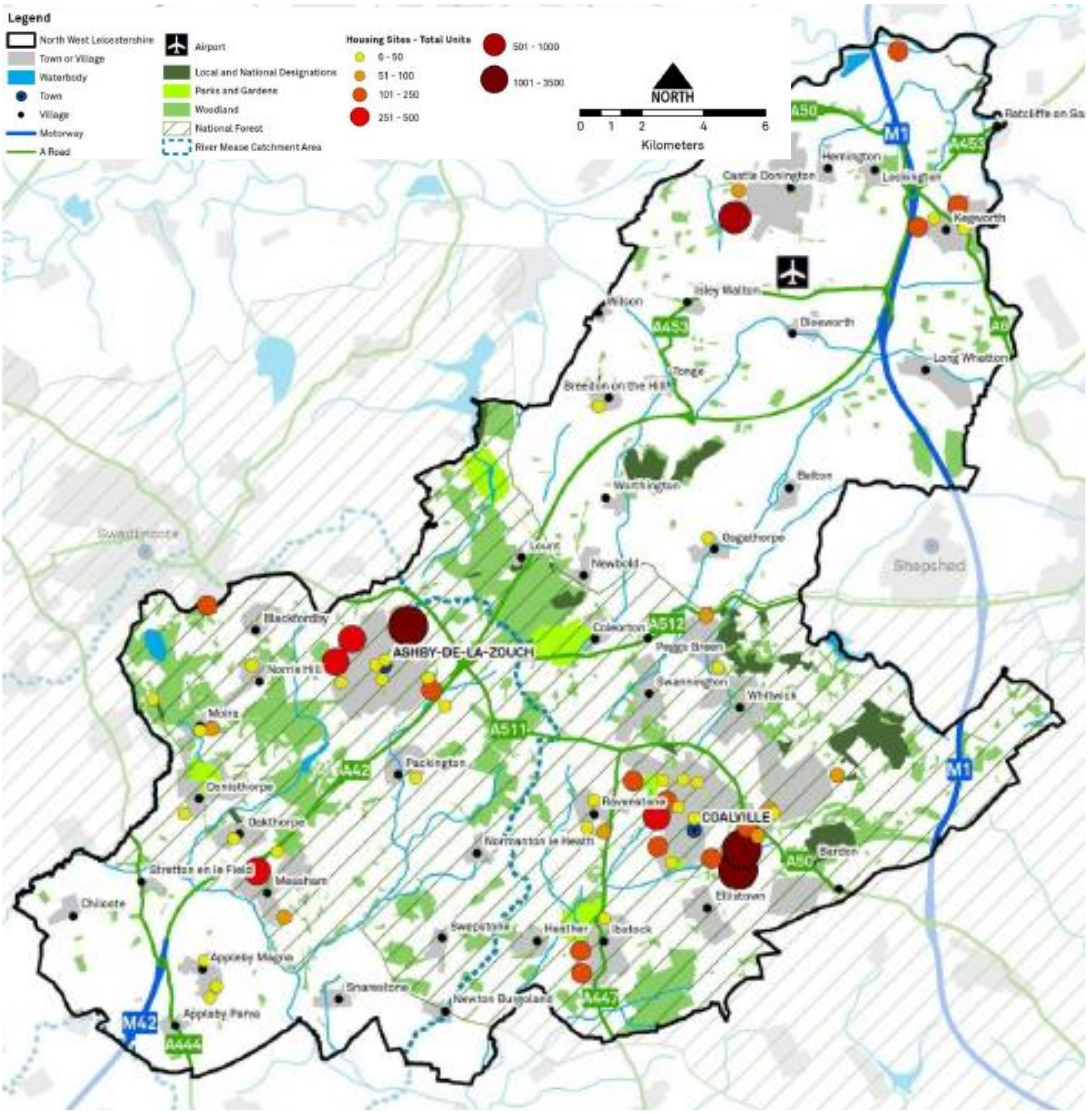


Figure 15.04 – National Forest and other woodland across North West Leicestershire, Source: AECOM, 2016

Data from BEIS suggests that LULUCF in the district currently provides emissions reductions of just over 1%, around half the UK National average.

[69] AECOM (2016) *North West Leicestershire District Council Infrastructure Delivery Plan*

A Habitat Survey undertaken in 2009 identifies that the district is made up mostly of a patchwork of arable land, grassland, improved grassland and woodland. There are few wetlands in the district – the last remaining heathlands are at the summit of Bardon Hill and parts of Charnwood lodge and are therefore considered some of the most important habitat in the district.

Policy: North West Leicestershire Local Plan

The Adopted Local Plan does not contain any specific policies for agricultural land, other than to protect it in general.

The Local Plan contains policies that require the provision of Green Infrastructure in new housing provision allocations and other developments (Policies H3, IF1, IF4, En1, CC3).

15.3 Agriculture, Forestry and Land Use: Actions towards Zero Carbon for NWLDC

Changing diets

Surveys have indicated that the proportion of people in the district who eat a healthy diet (i.e. 5 portions of fruit and vegetables a day) is lower than the national average. A switch to a lower meat diet is an important part of reducing GHG emissions from agriculture, by reducing the number of livestock. Public information nationally is clearly not having enough impact. Setting an example by reducing the meat element of food served in the district in Council owned and operated buildings but more importantly in public buildings such as schools and hospitals, sets a good example and raises awareness directly. Clearly, the primary reason for encouraging people to eat less meat has been for their own health and wellbeing. Reducing GHG emissions is largely a secondary benefit, but an important one in this context.

An emphasis on schools, both in the food served and in education of the need for change will have multiple benefits in the medium and long term. Focusing on the procurement of the fresh fruit and vegetables from local farms also has additional benefits for the economy as well as reducing 'food miles'.

Forestry

The Council's residual emissions that must be offset are estimated to be around 2.2 $kTCO_2e$ each year by 2030, while the district as a whole will need to offset 154 $kTCO_2e$ each year in the Net Zero scenario. Based on Forestry Commission[70] estimates of woodland potential to sequester 5-20 TCO_2e a year, between 7,810 and 31,240 hectares of woodland will be required to achieve Net Zero GHG emissions.

This represents an increase of almost two to seven times the current level of woodland cover. As the district's entire area is 27,900 hectares, the upper limits of woodland cover are clearly not achievable. This shows the importance of fully pursuing all possible actions to reduce GHG emissions, to ensure the residual emissions can be sequestered using the available land area.

There are specific techniques for management that improve the ability of woodlands to sequester carbon. Conifer woodlands are generally managed in order to protect the value of the 'crop' when it is harvested. Broadleaf woodlands used to be similarly managed but recently that practice has declined especially in small woods and in parks and green spaces. Within the context of the National Forest, investment in training a team of staff able to improve the management of the existing woodlands in the district will have economic benefits as well as reducing net carbon emissions.

This team could be directly employed by the Council or may be employed by the National Forest. They could use the knowledge to further improve net emissions locally by informing and assisting farmers to improve the management of woodlands and hedgerows on their land.

Engaging with national and local partners

There are a number of organisations nationally who have a role to play in delivering the national targets and who could provide support and guidance and possibly even some resources locally.

Partner	Potential Role

[70] Forestry Commission (2012) *Understanding the carbon and greenhouse gas balance of forests in Britain*

National Forest	Established in 1995 to lead the creation of the National Forest environmental regeneration project. Existing role could be continued and expanded.
Forestry Commission	Principle UK agency tasked with delivering afforestation. May be able to advise on most effective strategies for carbon sequestration.
Woodland Trust	Actively engaged in tree planting programmes. In response to the CCC proposal to treble or more the rate of tree planting in the UK, they have suggested enrichment of hedgerows in addition to creation of new woodlands as a viable way to increase the number of trees without having to find vast tracts of unused land. May be able to advise on additional ways of sequestering carbon.
Environment Agency	Engaged in various research programmes on land management and the use of trees and hedgerows to improve flood management. They also have a role to play in restoration of wetlands, to ensure proper control of hydrology to manage flood risks.
Agroforestry Trust	Extensively researched the benefits of alternative farming techniques to improve the sustainability of farming and food production, specifically in the UK. Could assist with providing guidance on broader land management
Local and national wildlife trusts and charities	Interested in management of specific habitats, for example the RSPB have a particular focus on the restoration of heathlands.

Table 15.01 – National and Local Partners

15.4 Other reasons to act

15.4.1 Additional benefits

This form of carbon capture is aligned with natural systems, and infers many other wider benefits, such as an increase in ecological habitat and biodiversity, public amenity and reducing the urban heat island effect. Both restored wetlands and woodlands have a far greater capacity to absorb and attenuate surface water run off than developed land or non-managed grassland, providing better flood risk management especially during heavy rainfall that is expected to occur more frequently as Climate Change progresses.

The Adopted Local Plan recognises the benefits of increasing Green Infrastructure to the district, including:

- Places for outdoor relaxation and play;
- Space and habitat for wildlife with access to nature for people;
- Climate change adaptation – for example flood alleviation. They also counter the 'heat island' effect in urban areas by cooling the heat retained in buildings and streets;
- Improving air quality;
- Environmental education;
- Local food production – in allotments, gardens and agriculture;
- Improved health and well-being – lowering stress levels and providing opportunities for exercise;
- Attract economic investment

15.4.2 Price of inaction

Trees and woodlands take time to grow and mature and the carbon capture potential increases over time. Therefore, to make the most of this opportunity early action is key.

Inaction by the agricultural sector will mean it becomes a bigger contributor of emissions relative proportion of CO_2 emissions in the UK. This could lead to resorting to "quick win" but sub-optimal solutions for the sector, the environment and public health. Innovative, sustainable and holistically beneficial solutions can take time to develop.

16.0 OTHERS: INDUSTRY, AVIATION AND F-GASES

This group of emissions sources are those over which the Council has the least opportunity for direct control action. Industrial and aviation emissions account for a substantial proportion of the national and international Greenhouse Gas Emissions.

Effective reductions in these emissions will rely on every district and every individual taking steps to reduce their own call on these resources if the objective of zero carbon is to be achieved.

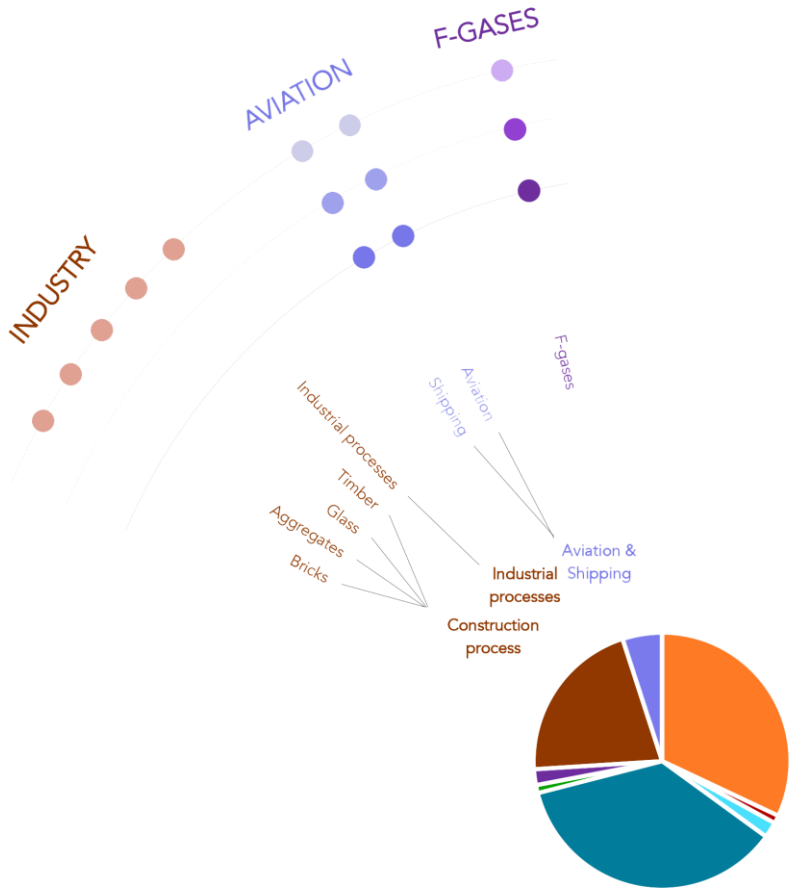


Figure 16.01 - Other required decarbonisation efforts in NWL

16.1 Industry, aviation and F-gases: National context

Greenhouse gas emissions from industry account for around 20% of the UK total, just over half of which are from manufacturing and the rest from fossil fuel production. Emissions from this sector have decreased steadily, while output has increased, as a result, principally of better efficiency and shift to lower carbon intensity industries.

Technologies to capture and store carbon from the air are being developed. Currently the most efficient carbon capture 'machines' available are trees, but industrialised processes, including the use of carbonated waste in the manufacture of construction products, are currently available and are being developed to improve efficiency and cost effectiveness.

According to the Committee for Climate Change report, aviation and shipping GHG emissions make up around 10% of the UK Total emissions, with international aviation, especially long-haul flights, the largest component within that sector. Emissions from aviation are rising, while those from shipping are decreasing.

Fluorinated gases – F-gases – are released in very small volumes but they are very powerful Greenhouse gases, so have a disproportionately high impact on Climate Change. F-gas emissions account for around 3% of UK Total GHG emissions and are slowly decreasing. The largest source of emissions is now the refrigeration, air-conditioning and heat pump (RACHP) sector, where emissions are released due to refrigerant leakage from appliances.

16.2 Industry, aviation and F-gases: context in North West Leicestershire

According to BEIS data, the largest industrial emitters of greenhouse gases in North West Leicestershire are all associated with the construction industry – brick makers and quarries.

East Midlands Airport has a published carbon emissions policy for its operations on the ground. Emissions from flights are accounted separately. For safety reasons, a wide area surrounding the airport cannot be used for development or for landscape or biodiverse habitat creation, increasing the indirect impact that the airport has on the district overall. The growth targets and Planning restrictions relating to the airport are set nationally.

There is no regional data on F-gas emissions.

Appendices

APPENDIX A – GREENHOUSE GAS EMISSIONS REPORTING AND MONITORING

Any robust programme of emissions reductions starts with a clear approach to the understanding and quantification of existing and potential future emissions. This section explains the sectors considered in this analysis and how these fit with the Council's existing and future responsibilities (including reporting). As part of our analysis we have reviewed guidelines and precedents for reporting on greenhouse gas emissions, including the national carbon reduction reporting by Committee on Climate Change (CCC) the Greenhouse Gas Protocol (GHG P), the UK government GHG reporting guidelines and other Local Authority carbon reduction plans.

Sectors, responsibility and control

The identification of sectors to include in the analysis is a key consideration of a CO_2 assessment and mitigation strategy. There must be a balance between including all major CO_2 sources and sinks, and producing a strategy that is measurable and achievable.

We reviewed the IPCC Guidelines on greenhouse gas inventories, which gives a very detailed breakdown of potential emissions in terms of Energy, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use and Waste, but is practically too onerous for NWLDC to use.

We also reviewed 20 local authority carbon emissions reduction strategies, which generally have a far reduced scope in their assessments.

Our recommendation is to use the very useful framework set by the Committee on Climate Change (CCC) in their reports on the UK's greenhouse gas emissions, which give a national precedent for how to assess reductions on a sector by sector basis. The latest report sets out a pathway to phase out greenhouse gas emissions by 2050 to end UK contribution to global warming. The sectors considered are Power, Industry, Buildings, Transport, Aviation and Shipping, Agriculture, Land-use, Land use change and forestry, Waste, F-gas emissions and Greenhouse gas removals. Aligning with these sectors as much as possible will also help to relate to national progress in the future.

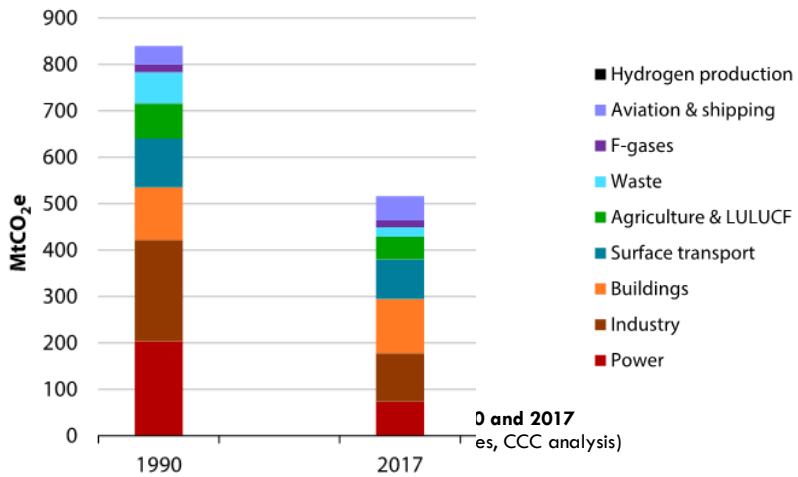


Figure A **0 and 2017**
(Source: es, CCC analysis)

It can be seen from the figure above that emissions from some sectors (Power, Industry, Waste) have reduced significantly already since 1990 but that emissions from other sectors (e.g. Transport, Buildings) have not reduced significantly.

Our recommendation is to seek to remain as consistent as possible with the Committee on Climate Change sectors. The table below provides the proposed sector breakdown for NWL emissions. When adjustments were made compared with the CCC framework, notes have been added.

Sector for NWL emissions	Action area	*Notes*
Buildings and towns	Domestic buildings Non-domestic buildings	*This includes electricity used by buildings and street lighting*
Power	Electricity generation	

	Hydrogen	*There is no power station in NWL so this section focuses on renewable energy generators and new energy infrastructure (e.g. hydrogen)*
Waste	Domestic waste Non-domestic waste Construction waste Wastewater	*Apart from waste generated in Council's buildings, these are not direct emissions, but the Council has a significant influence on how much they can be reduced by, particularly organic waste*
Transport	Organisation vehicles Private vehicles Infrastructure	
Forestry, land use and agriculture	Forestry Wetlands Heathlands Agriculture	
Industry	Industrial processes Construction products	
Aviation and shipping	Aviation Shipping	*These emissions have been considered on a 'fair share' basis rather than direct emissions*
F-gases	F-gases	
Greenhouse gas removal	BECCS Direct air capture	

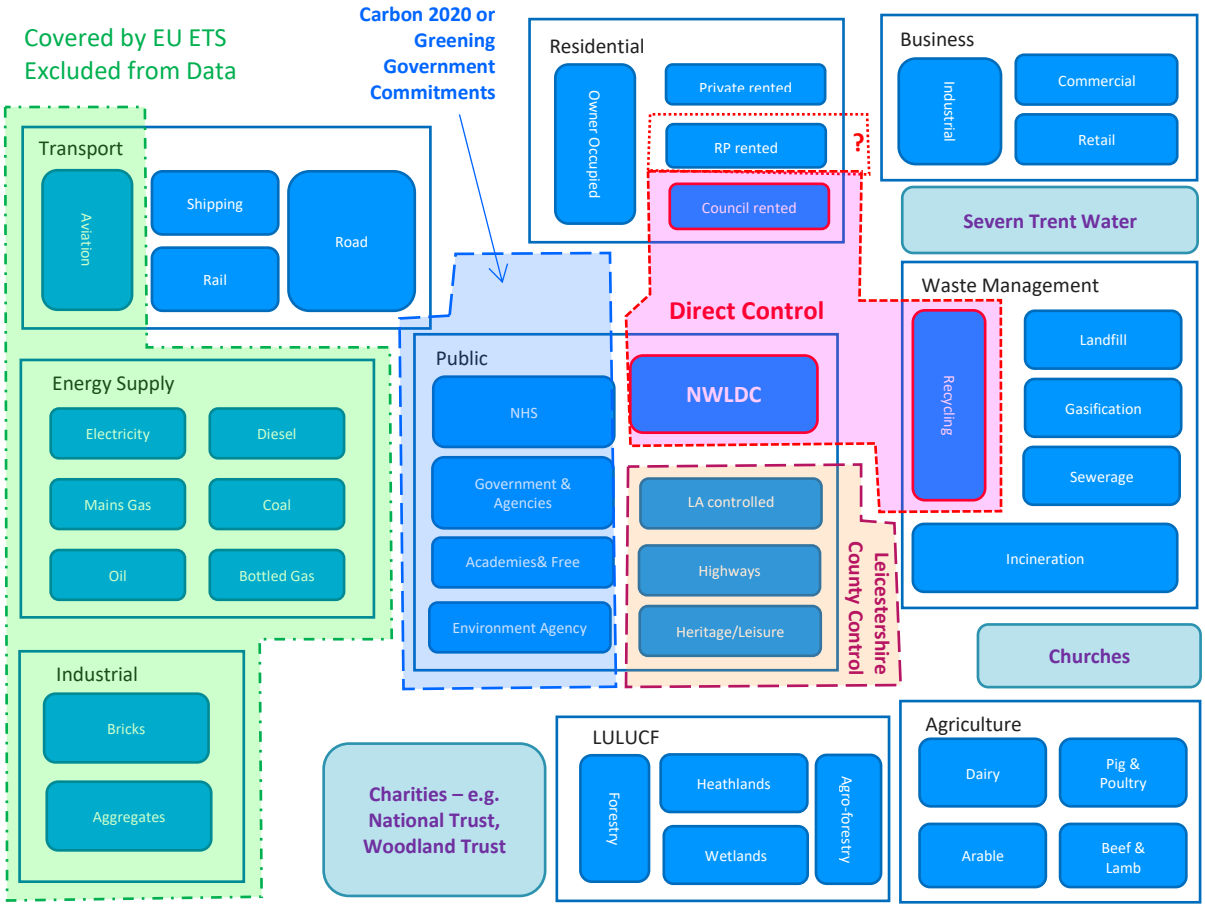
Table AppA.01 – Proposed greenhouse gas emissions breakdown for North West Leicestershire

APPENDIX B – RESPONSIBILITIES FOR CARBON REDUCTIONS

Municipal responsibilities within the district are split between NWL District Council and Leicestershire County Council.

North West Leicestershire District Council responsibilities	Leicestershire County Council responsibilities
• Council owned and occupied buildings • Council owned and let buildings • Social and sheltered housing • Leisure centres and sports facilities • Parks and open spaces • Waste management • Community transport • Car parks (including lighting)	• Highways (including street lighting) • Public transport • Schools • Libraries • Care and nursing homes • Providing care at home

The figure below aims at representing the responsibilities beyond North West Leicestershire District Council's and Leicestershire County Council's.



APPENDIX C - SETTING OBJECTIVES

We have drawn on the recommendations from the *GHG-P Mitigation Goal Standard* on setting an overall emission reduction goal and evaluating whether it is being met further down the line. This requires consideration of several factors to clarify the context and boundaries of the goal.

Greenhouse Gas (GHGs) included	The NWLDC goal will mainly consider CO_2 emissions. However, the impact of other GHGs will also be addressed,
Jurisdiction	Out-of-jurisdiction emissions are those that occur outside of the jurisdiction but because of in-jurisdiction activities. Jurisdiction encompasses geography and control. Geographically, the NWLDC emissions goal is based mainly on in-jurisdiction emissions.
Goal period	The overall goal period has been set to 2050, however there are interim goals that align with NWLDC's other reporting responsibilities and other key milestones have been set.
Goal type	There are options to set the goal as fixed-level or in relation to a base year or a future scenario (e.g. business as usual). This goal has been set as a reduction in total CO_2 emissions on a 2016 base year, as this is significantly more reliable than 1990 emissions data. A reduction on a business as usual scenario was considered but this is less clear than reporting on a base year. The equivalent fixed-level absolute goals per sector in both CO_2 and kWh will also be presented for clarity of future comparison and reporting.
Allowable emissions	We have established maximum allowable emissions per sector in the final year of the goal period, to account for the fact that it is harder to reduce emissions in some sectors than others.
Transferable credits	This refers to offsetting with emissions units from outside the goal boundary applied toward the goal. This analysis does not include any allowance for transferable credits.
Emissions inventory	We have developed a tool to capture current emissions and then used this as a basis from which to develop CO_2 mitigation solutions.

APPENDIX D - HISTORICAL AND PROJECTED CARBON FACTORS FOR GRID ELECTRICITY

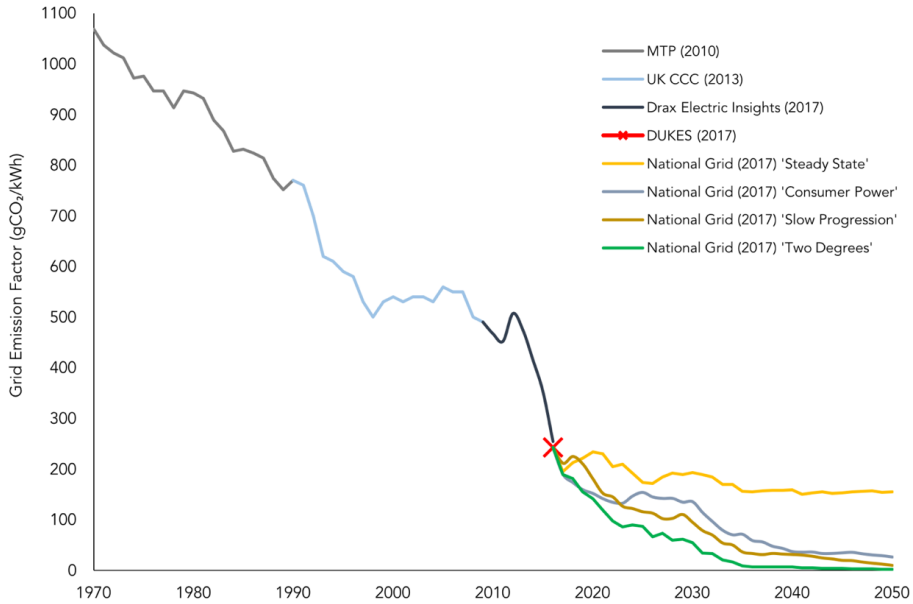


Figure AppD.01 – Historical and projected carbon factors for grid electricity (data corrected for continuity between sources)

The **Market Transformation Programme (MTP)** data shows system average values for the years 1970-2005. This historical data provides important context on how rapidly emission reductions for electricity have been achieved in the past, principally through the retirement of coal fired power stations, which have been replaced with gas-fired power stations, nuclear generation and increasingly, renewable energy.

The **UK Committee on Climate Change (CCC)** data is taken from the 2013 Fourth Carbon Budget Review. This data is partially based on similar datasets to historic MTP data and is therefore shown overlaid on top of MTP data from 1990 onwards.

The **Drax Electric Insights** data is taken from the Drax Electric Insights web page, which is maintained by the Drax Group and uses data from Elexon and the National Grid. The methodology for acquiring, processing and presenting the data was developed by Dr. Iain Staffell of Imperial College London. The methodology has been written up as an academic paper and published in the journal 'Energy Policy'. The mathematics behind it have been independently reviewed by Dr. Grant Wilson, a leading UK academic.

The **Department for Business, Energy and Industrial Strategy's** single figure for 2016 from the Digest of UK Energy Statistics (DUKES) 2017 is provisional at the time this document is published. This figure is however broadly in line with other datasets including the Drax Electric Insights website and the National Grid's Future Energy Scenarios.

The **National Grid's 2017 Future Energy Scenarios** present four different scenarios for electricity supply and demand through to 2050. While these are not intended as predictions, they do represent plausible pathways for the UK's future electricity mix. In the majority of scenarios there is a consistent trend for rapid decarbonisation of electricity supplies between 2015 and 2020 due to the retirement of coal fired power stations. This is driven by a combination of the EU Large Combustion Plant Directive, the EU Industrial Emission Directive and the UK carbon price floor, all of which present an increasingly adverse regulatory and economic environment for coal power generation.

Whilst changes to these policies may affect the length of time the last few coal power stations in the UK remain open, there is a clear trend towards elimination of coal from the generation mix, with the Longannet, Ferrybridge C and Rugeley closures in 2016 removing around 4GW of coal capacity from the grid and more closures expected soon.

Post 2020, subsequent declines in carbon content occur at a reduced rate due to a more gradual replacement of lower emission gas-fired power stations with nuclear power stations and renewable energy. It is during this second phase of decarbonisation (from 200 g of CO_2 per kWh and below), that the scenarios diverge due to differing assumptions on the relative proportions of remaining fossil fuel generation capacity compared to low carbon sources such as renewables and nuclear.

APPENDIX E – BEIS DATA

The Department for Business, Energy and Industrial Strategy (BEIS) issue regularly information on the reported emissions from all sources in the UK.

The data is compiled from 4 principal sources:

- BEIS sub-national gas and electricity consumption statistics
- Point source emissions from large industrial installations
- High resolution emissions distribution maps developed under the National Atmospheric Emissions Inventory (NAEI) programme
- Land use, land use change and forestry (LULUCF) regional data supplied by the Centre of Ecology and Hydrology (CEH), under the NAEI programme

The processes by which the data sources are converted into specific sector by sector emissions for each Local Authority are complex and, ultimately, are an approximation. Some key emissions sources are excluded because they cannot be meaningfully allocated to an end user, and therefore cannot be attributed to a specific locality (e.g. aviation).

The intention of the Government in compiling and issuing the data is to have a consistent set of information to allow meaningful comparisons to be made across sectors rather than it being an absolute and accurate measure of the actual emissions.

This is the best macro-scale data we have available as it shows the medium-term trend with consistent data measurement.

APPENDIX F – DETAILED CARBON FORECAST METHODOLOGY

Forecasting and accounting for Green House Gas emissions is highly complex, and there are multiple valid ways to look at the problem. Our approach has been to focus on capturing all emissions in the district, and to use available public data and Council information to estimate the breakdown for different sectors. The aim of this is to allow the Council to prioritise and focus efforts on where the largest reductions are required.

Reductions for buildings and transport are the most likely to be bespoke in the district and contribute a large proportion of emissions. These have been calculated from a 'bottom up' analysis of changes in stock and use. Where less is known about the source the reduction forecasts from the CCC Net Zero UK report have been used. Emissions that occur locally, but contribute to the national economy, such as industry and aviation have been shared between local authorities using population.

Carbon content of energy types

The carbon content of electricity and heat have been calculated over the period in a detailed analysis in section 11.0 and are assumed to change over time. The carbon content of other fuels is taken from Conversion Factors 2018[71] and is assumed to be static over the study period.

The large potential for renewable generation in the region is included in the national analysis and contributes to reduced carbon content of electricity. An approximation of the contribution to decarbonisation of electricity has been made.

Buildings

The historic emissions have been taken from BEIS Subnational gas and electricity data[72]. To forecast future emissions buildings have been split between residential and non-residential. For residential buildings the number of homes has been estimated from Ministry of Housing, Communities & Local Government housing stock data[73], and then each type assigned an energy use intensity. The increase in housing has been projected from the housing need presented in NWL Local Plan[74]. The potential change in energy use intensity for heating energy and electrical energy has then been specified for each case.

For non-residential buildings much less in known about the actual breakdown by use. An estimate for the total improvement in efficiency for heating and electrical consumption has been made using CCC targets, and comparison with residential reductions. This includes changes in use, and improvements in efficiency.

Current energy use intensity is taken from actual meter readings for existing buildings from NEED, BEIS and DEC database averages.

The change in building stock is broken down between:

- retained existing stock,
- renovation,
- new construction replacing existing,
- new construction.

Target energy use intensities are set for new construction and renovation. For business as usual these use an approximate kWh/m^2/yr figure to represent a 10% improvement over building regulations, in line with current planning requirements.

[71] UK Government GHG Conversion Factors for Company Reporting (BEIS), 2018
[72] BEIS 2018 data tables - Sub-national_electricity_consumption_statistics_2005-2017.xlsx, Sub-national_gas_consumption_statistics_2005-2017.xlsx retrieved from https://www.gov.uk/government/collections/total-final-energy-consumption-at-sub-national-level and related pages.
[73] MHCLG 2019 Live table 100 retrived from https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants

[74] NWL Local plan Appendix 2 Housing trajectory as of 1/10/2016

Residential
The rate of construction of new homes has been taken from the Local Plan housing trajectory October 2016. An additional 7,900 homes will be completed between 2016 and 2031 at the rates described in the document. This growth is then predicted to reduce to a steady rate achieving 2,500 further homes on sites identified up to 2050.

Annual new construction replacing existing dwellings baseline assumption of 1% per annum has been assumed. This is equivalent to about half the number of entirely new dwellings completed per year.

The rate of residential retrofit in the UK is currently estimated to be 7-14%, with higher rates in rural areas[75]. However, what is considered 'retrofit' is relatively loose, ranging from boiler replacement to loft insulation and only includes Government funded installations. Relatively few retrofits introduce whole house energy efficiency measures that could be considered to deliver very meaningful carbon reductions, therefore a notional baseline % retrofits per year of 5% has been assumed.

Non-residential
The breakdown by building type available for non-residential buildings at a subnational level is very poor, therefore non-residential emissions have been considered as a whole.

The total non-residential emissions from BEIS subnational gas and electricity statistics have been used as a baseline, and then reductions and some growth forecast using known development targets from the NWL Local Plan 2016.

- An additional 7,300sqm of retail floor space from 2016 to 2040.
- Strategic Rail Freight Interchange including an additional 9,000 sqm of distribution (B8 open air storage).

The CCC includes almost complete decarbonisation of direct emissions (gas) from non-domestic buildings in their 'Core' scenario. This is thought to be optimistic and so a more conservative assumption of 60% reduction in gas consumption has been used for the business as usual case.

Transport

Data is taken from Department for Transport road traffic forecasts. The current emissions for the district (based on use, not ownership) are used to estimate an emission per vehicle. Technology change and efficiency improvements are then assumed for each vehicle type. A 34% increase in road traffic is assumed through to

The market and incentives are assumed to mean that 60% of domestic and LGV transport is electric by 2050. HGV is assumed to achieve similar efficiencies to current electric buses through Hydrogen or alternate technology.

Air travel growth is taken from the CCC projections and the share for NWLDC worked out based on population. This gives 56 $ktCO_{2e}$ in 2017. This is a fair approximation as it means a proportion of emissions are assigned to districts without an airport. For comparison emissions due to flights leaving East Midlands airport were 297 ktCO2e in 2017, this means an equivalent to 81% of emissions from NWLDC are assigned to other local authorities.

Include figure showing this difference – it is interesting

Industry

The CCC give a 53% reduction in emissions by 2050 from heavy industry through adoption of heat networks, heat pumps and electrification, and change of fuel use. This has been applied to the 2016 baseline year to give total emissions in 2050, and then a profile of adoption assumed between the two values.

Climate

The effect of changing climate patterns over the study period is unknown, could change in either direction, and is not included. Any effect is assumed to be incorporated in building emissions projections. Historic heating emissions are not corrected for weather.

[75] Household Energy Efficiency Nation Statistics Detailed Report (BEIS), 2018